SEP 22 1930

VOLUME 58 [W. B. No. 1019] NUMBER 6

MONTHLY WEATHER REVIEW

JUNE, 1930

CONTENTS

	Page
Aviation weather hazards. Thomas R. Reed	231
Special series of sounding balloon observations made during the winter of [illegible]. Leroy T. Samuels	235
Supersaturation and ice on airplanes. W. J. Humphreys	245
Relations between winters in Manitoba and the following spring in eastern United States. Fred Greissmayr	246
Weather abnormalities in the United States (sixth note): Temperature distribution. A. J. Henry	247
Weather abnormalities in the United States (seventh note): Trend of precipitation. (2 figs.) A. J. Henry	249
Record rainfall for Miami, Fla. George V. Fish	251
Notes, Abstracts, and Reviews:	
An upper-air [illegible] indicator for use with pilot balloons. [illegible]	252
The electric field of overhead thunderclouds. S. K. Banerji	252
A new rainfall chart of the earth. A. J. H.	252
Notes, Abstracts, and Reviews—Continued.	
The rôle of the oceans in the weather of western Europe. C. E. P. Brooks	252
Notes on rainfall and evaporation. G. E. P. Smith	253
South African rainfall effectively presented by new graphical method. Donald S. Gates	254
Tornado in New Mexico. C. E. Linney	254
Oceanic, continental, Mediterranean, and boreal climatic influences and mountain climate in Europe. (1 fig.) Paul Teleki	255
Bibliography	256
Solar Observations	256
Aerological Observations	258
Weather in the United States	260
Weather on the Atlantic and Pacific Oceans	285
Climatological Tables	292
Charts I–VI, VIII–XI.	

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU
WASHINGTON, D. C.

For sale by the Superintendent of Documents, Washington, D. C. - - -

CORRECTIONS

Monthly Weather Review:

August, 1927, Vol. 55: Page 349, Table 1, column headed "St. Louis" (Warm), the first line should read "1891" and "5.7" instead of "1901" and "5.4," respectively.

August, 1929: Page 329, second column, 28th line from the bottom, "20.70 inches" should be "29.70 inches."

April, 1930: Pages 143 and 145, the illustration on page 143 belongs on page 145; the illustration on page 145 belongs on page 143. The legend to the latter is "Figure 1.—Alignment diagram for the Bowen formula."

MONTHLY WEATHER REVIEW

Editor, ALFRED J. HENRY

VOL. 58, No. 6
W. B. No. 1019

JUNE, 1930

CLOSED August 3, 1930
ISSUED SEPTEMBER 5, 1930

AVIATION WEATHER HAZARDS

[Weather Bureau Office, San Francisco, Calif., May, 1930]

The primary object of an airways weather service is to insure the safety of flight. It has other purposes, admittedly, but they are secondary. This does not mean that they are for that reason to be neglected or that any effort should be spared to accomplish them. It does mean, however, that the personnel of an airways weather service should never lose sight of the primary object of the service, which is to insure the immunity of passengers, pilots, and equipment against any and all accidents arising from or attributable to untoward weather on the airways or in the area over which they have supervision or for which they are responsible for advices. This fact being admitted it is pertinent to inquire (1) what the relation of weather in general is to the safety of flight, and (2) what conditions of weather preeminently militate against it.

The answer to question (1) may seem so self-evident to some that to offer it is to exhaust the obvious. Nevertheless it is not equally evident to all, and ignorance on this point sometimes prevails in quarters where it is least to be expected and where its existence constitutes a menace to safe flying operations. The personnel of an airways weather service should be in no doubt at all in regard to it; indeed, they should be so thoroughly informed on the subject as to feel no diffidence in asserting and maintaining the facts even in the face of doubt or contradiction from pilots or operators whose inexperience may lead them to discount weather hazards. Among the experienced there will always be excellent agreement, for to the seasoned pilot or operator no doubt exists as to the place weather occupies in the picture; all admit that it is the outstanding problem confronting safe flying operations to-day. Other problems which once seemed portentious, such as engine failure, structural failure, airport deficiencies, etc., while far from having reached their ultimate solution, have been coped with to a degree that has removed them from a position in the foreground. On the other hand, the factor of weather becomes more and more conspicuous. An official in one of the largest air transport companies in the West, after a year's operation, stated publicly that all the serious difficulties encountered by his company had been traceable directly or indirectly to the weather. Similar testimony could undoubtedly be offered by practically all air transport and air mail operators. It is a conclusion so obvious as to require no emphasis were it not for the unfortunate fact that certain enthusiasts in their efforts to promote public acceptance of aviation have circulated and encouraged the belief that the weather problem is no longer an obstacle to the safety and regularity of flight. The apparently contradictory views thus engendered have led to widespread doubt and in some cases actual misconception in this regard.

To cite an illustration of how such misconceptions gain momentum, mention may be made of the assertion uttered frequently in the course of his public addresses by a pilot of national prominence, admirable conservatism and matchless skill, to the effect that "flying is now possible in almost any kind of weather." Certainly he has proved it so in his own case. But mark the terms he employed. He said it was *possible*; he did not say it was *safe*. This same pilot has abandoned his plane and descended by parachute four times in the course of his career as an aviator. Twice out of these four times it was weather that compelled him to jump—weather in which he found it *possible* to fly, but did not find it *safe*.

The personnel of an airways weather service should not ordinarily be governed by the consideration as to whether it is possible to fly, but whether it is safe. This is imperative where flying involves the transport of passengers; nothing should outweigh the injunction, "safety first." The degree of hazard, if any, may be weighed, and the question of relative safety decided accordingly; but decision should nearly always be on the basis of safety, and not the fortuitous one of possibility. The exceptions to this rule should only be allowed in the case of emergency flights which require the journey to be made even at considerable risk, such as in the movement of police forces or the dispatch of planes on other missions where public or private necessity supersedes the usual limits prescribed by caution. A larger margin of risk is conceded to the operations of the air mail, too, where such operations do not involve the transport of passengers. This distinction is commonly made by air-mail companies as a matter of course. It is not at all unusual for them to reject applications for passage, or even to cancel passage already sold, because of inimical weather conditions along the route, the plane, however, departing as usual but freighted only with the pilot and his cargo of mail. Here is a case of the operating company or pilot being governed by the consideration of whether the flight is possible or not, and disregarding, except in the matter of passengers, the question of safety. Even in the transport of mail, however, evidence points to the increasing conservatism being exercised by air mail contractors in the movement of mails alone. The loss of life may be limited to one—the pilot—but the loss of the ship is an expensive matter to the company, and the loss of important mails disastrous to air-mail patrons.

Before leaving the subject of weather in general as the predominating cause of airplane accidents, explanation is in order regarding the apparent contradiction this assertion may seem to invite from Department of Commerce statistics, which assign only 5 per cent of airplane accidents to this cause. The Department of Commerce bases its calculations on accidents contingent on all types of flying—student flying, practice flying, sport flying, professional flying, etc.—while the assertion which seems to be in conflict is intended to apply to one type alone, viz, professional flying or flying of the transport type. This latter type is deservedly in a class by itself and its casualty statistics should be segregated accordingly. Errors of piloting and mechanical difficulties, so preponderant as a source of accident in amateur or casual flying, are relatively insignificant in transport aviation; the pilots are men of ample experience and thorough training and the equipment usually of standard make and competently serviced. These precautions virtually eliminate from transport aviation the hazards so common to other types of flying and leave the weather factor predominant. It remains predominant for the obvious reson that the very nature of transport aviation makes it so; i. e., the attempt to fly regularly, day after day, or night after night, over a given route and maintain with as little interruption as practicable a prearranged schedule for the convenience of passengers and the transport of mails. Let any one recall the major accidents which occurred in flying of the transport type during the last year and it will be difficult to cite spontaneously any which were not directly attributable to weather. Memory, on the other hand, easily reverts to outstanding accidents that were so—the T. A. T. transport which was caught in a thundercloud over New Mexico and drifted into a mountain; the Maddux trimotor which was forced by descending ceiling to make a low-altitude turn in the darkness near Oceanside, Calif., scraping a wing in the maneuver with fatal results; the western air mail plane which went down a total loss in a snowstorm on a night flight between Salt Lake City and Los Angeles; the trimotor belonging to the same company which was caught in clouds over the mountains near Los Angeles and crashed in a canyon—these and perhaps other casualties spring to mind without effort, all of then directly attributable to weather.

The extent to which weather conditions affect the safety of flight being recognized, it becomes pertinent to inquire what are the particular forms of weather which introduce hazard and against which pilots and operators must be on guard. Concisely stated, these hazards are exactly two in number—fog and sleet. The term "fog," however, must be stretched to accommodate the airman's definition of it, which includes all cloud formations in which he may be immersed, or more broadly still, any atmospheric conditions which result in loss of vision.

It is easily understood and freely admitted that ground fog is a well-nigh insuperable obstacle to safe flying, because of the difficulty it introduces in landing and taking off. The merest tyro can understand the necessity of clear vision for the safe performance of either operation, especially the former. An experienced pilot can take a plane off the ground in a dense fog and fly by aid of instruments until the fog layer has been surmounted. Air-mail pilots call this "pulling the fog," and they occasionally do it to insure the transport of mails on schedule. It can not be classed with safe flying, however, for the reason that in case of motor failure, descent through the fog to a landing is almost certain to end in disaster. In other words, a take-off in the fog involves the possibility of a blind landing, and blind landings are wholly without the pale of requirements demanded by safe flying.

The menace of sleet—a term in use among pilots to describe ice formations on the plane—is also well understood and freely admitted. No one with the slightest understanding of aerodynamics can be in doubt as to the hazard introduced by this phenomenon. Since a wing obtains its "lift" from the reaction of forces brought into play as the result of its passage through the air, such reaction being mainly induced by its peculiar shape and curvature, it is obvious that any deformation of the airfoil will impair and possibly destroy its function. Ice deposits produce such deformation, render the plane unmanageable, and in extreme cases make it incapable of sustentation. It is not, as some may suppose, the addition of an unwonted ice load that introduces danger, so much as the change in contour of the airfoil which ice coating brings about. Various schemes have been experimented with or suggested to combat this danger, but none of them has removed it. One plan proposes to heat the wings by various means; another suggests the use of wing-coatings of oil or wax on which ice will not collect; but nothing practical has evolved from either.

Ice may form on the ship when flying through freezing rain, but more often when flying through clouds composed of subcooled water droplets. The most dangerous temperatures are generally believed to be between 32° F. and 28° F., although Andrus states that the range may be much greater.[1] All agree that at present the only way of coping with ice is to avoid it. Says Andrus in the article referred to:

> The ice problem is attracting widespread and expert attention. Its solution by many means has been proposed and devices and means are constantly being evolved by which the icing up of planes may be rendered harmless or impossible. The soundest means, that of avoidance, can not always be adopted, as conditions must be recognized well in advance to ensure avoiding those suitable for ice, and airplanes occasionally are caught unawares by sudden changes unanticipated. Nevertheless, avoidance is the best known method of reducing disasters in this field.

Bradley Jones says:[2]

> Winter flying is hazardous. Cancelling trips under threatening weather conditions is a safety-first solution. * * * Oil or grease coatings are not always completely effective. Heating the wings should work out as the expense of reducing the plane's efficiency, but this solution has only been projected and not actually tried out. At present it is up to the pilot to keep out of the stratum of air wherein ice is liable to form.

That sleet and ground fog are very serious sources of weather hazard to aviation, perhaps the most serious, no one will deny; but they are by no means the only ones. As stated in the outset any atmospheric condition which precludes vision is a menace to safe flying; and our understanding of weather hazards must include those offered by cloud formations of any kind which are so disposed as to require the pilot to traverse them in the course of his journey. It is on this point—the dangers of cloud flying—that misconception is rife. Many suppose that it is as simple a matter to fly in clouds as to fly above or below them; others may imagine that the only obstacle offered by clouds is the difficulty of climbing through them to the region of good visibility above, and that once the cloud layer has been surmounted the rest will be plain sailing. It would surprise such individuals to know how seldom, relatively speaking, transport pilots do either in very stormy weather unless compelled to by circumstances.

[1] Meteorological Notes on the Formation of Ice on Aircraft, by C. G. Andrus, Monthly Weather Review, vol. 58, p. 22.
[2] Icy Wings, by Bradley Jones, U. S. Air Services, April, 1930, p. 24.

Of course flying above the clouds involves no hazard until it becomes necessary to descend, but that ultimate necessity may never be disregarded. Motor failure may require it at any time, but even if that contingency is waived, there remains the question of final descent at the airport of destination. The radiobeacon and radio communications may reduce the hazard for planes equipped to utilize such aids, but all planes are not so equipped, and even those that are must face the possibility of a blind landing should the radio broadcast inform them that the cloud level has lowered while they are in flight and now rests on the ground. Flying above storm clouds is to be shunned except under special conditions: First, because of the uncertainties of surface weather conditions (height of ceiling) in the event of a landing; second, because of dangers incidental to climbing through the cloud stratum if it is very deep and the possibility of not being able to surmount it at all; and third, because of navigational considerations. The first-named hazard is naturally at a maximum in cyclonic conditions and over mountainous country, and at a minimum over level country especially where stratiform cloudiness of relatively shallow type and adequate ceiling is involved. All three hazards are greatest at night and least by day. The following examples will suffice, although if space permitted they could easily be multiplied. Until recently when a new and relatively fog-free airport was secured in the Los Angeles area, the mail contractor whose duty it was to dispatch the northbound mail at midnight was seriously bothered by the canopy of so-called high fog which frequently formed over his airport during the late evening. Unless the ceiling formed in this way was quite high, say a thousand feet or more, the company would not risk a night flight through the cloud layer to the clear air above but would send the mail out of the area by automobile to the nearest fog-free field available, whence the remainder of the journey would be made by air. This fact was duly impressed on the airway-weather personnel as it was incumbent on them so far as possible to apprize the field manager of fog probability and allow him time enough to have a plane ready at a field outside the overcast area. Navigational difficulties incidental to flight above a cloud sheet were illustrated by Colonel Lindbergh's error in calculating his course to Mexico City, at the time of his famous nonstop flight there from Washington. The cloud layer below him prevented any check on his "drift" with the result that, although all things considered, his journey was a masterly exhibition of navigation by dead reckoning, he found himself considerably off his course when the sky finally cleared.

While flight above a cloud layer presents certain hazards, especially in rough country where the cloud sheet envelops or rests upon a mountain range and thus makes a crack-up almost certain in case of a "dead-stick" landing, it at present offers the only alternative to flying below the cloud stratum. Flying below the stratum is usually preferred; it enables the pilot to keep strictly on his course and if the course be along an established airway it will be well provided with intermediate landing fields on which emergency descent may be made. It may, furthermore, be provided with lights for his guidance by night. Flying below the clouds he has the choice, in case of a lowering ceiling, of "sitting down" or turning back. The same is true if snow, rain, or mist set in. Snow is very obstructive to visibility: rain much less so. However, in canyon flying the cloud level is likely to be so low in the case of rain as to presage very dangerous conditions.

It has been said of mail pilots on the Pacific coast Airway that in bad weather they do not fly over the Siskiyou Mountains, but through them. They thread the tortuous passes, sometimes in weather so thick that the canyon walls are obscured on either side. Their method then is to weave from side to side of the canyon, swerving out of danger as the mountain wall looms on either hand. This can not be classed as safe flying, and on such occasions no passengers are carried. During part of the fire season in the Pacific Northwest last fall, a pall of smoke hung over large portions of the airway in western Oregon, and had much the same effect on flying operations that fog might have had. It will be remembered that for many days while the fires were at their worst, passengers were not carried on the transport lines in western Oregon as the condition of visibility made flying unsafe. Pilots had to fly by instruments alone until they were above the smoke layer, and face the threat of a blind landing at any time en route in case of motor failure.

This reference to flying by instruments brings up for consideration the concluding thought which it is desired to present for the contemplation of meteorologists who are serving the interests of aviation. It is a point on which there is considerable divergence of opinion within the flying fraternity itself, and the personnel of an airway weather service should understand thoroughly the nature of the problem and the occasion for the existing disagreement.

The term "instrument flying" is commonly used to denote the means employed by the pilot to keep his plane under control and on its course when view of the earth, sky, and horizon is obliterated. Other terms having substantially the same meaning in pilot's vernacular are "fog flying" or more often, "blind flying." Actually there is a distinction which should be drawn in the use of these expressions. "Fog flying" obviously refers to flying under a single kind of atmospheric condition only. "Blind flying" should not be confused with instrument flying, although this is frequently done, because, strictly speaking, "blind flying" is flying without vision and without the aid of instruments either.

Blind flying should never be attempted. It has been thoroughly proved in recent years that to fly "blind" without the aid of instruments is to invite disaster. Pilots who imagine they can fly blind for any length of time are altogether deluded, and there are very few who will push such a claim to-day, although in former years there were not a few who believed they could do it. In some cases they did and returned to tell the tale; but it was undoubtedly a case of the ship flying itself and the pilot having sense enough to let it. As a matter of fact neither the sense of direction nor the sense of equilibrium can be relied upon after the vision has been completely destroyed; the pilot can not tell except by instrumental means whether the ship is climbing, nosing down, banking, turning, or stalling. If in an open cockpit he can detect a skid or a slip by feeling the air strike him on one cheek or the other, but in a closed cabin this source of information is excluded, and except for his instrument board he has no warning of his peril. In former days the only instruments the pilot had to aid him in such an emergency were his compass, his air speed indicator, and his altimeter. If he was exceedingly careful his compass

kept him flying straight; his air speed indicator showed him whether he was maintaining flying speed or approaching a stall; his altimeter kept him informed of his height above his starting point. Once the ship got into a spin, however, his compass became useless and he had no instrumental means to guide him in the recovery of control.

In recent years important additions have been made to the foregoing equipment. Chief among these is the bank-and-turn indicator which shows the pilot whether he is turning or skidding and in what direction. The rate-of-climb indicator which shows him whether he is climbing or nosing down has also been brought out; the earth-inductor compass has been evolved; the radio direction finder and the capacity altimeter have been developed. All these aids have tended to make instrument flying more feasible, and may at first glance seem to have made it quite safe. This, however, is to assume a great deal too much. Indeed, it is upon this point that people within the industry are not wholly in agreement. Proponents of instrument flying point out that with so complete an instrument board, instrument flying is only a matter of training and practice. Most pilots, however, and notably those with years of flying experience, are loath to entrust themselves to it, and only do so when they have to and then for as short a time as possible. They point out with excellent reason the degree of concentration such flying demands, and say that to sustain it for any length of time is asking a good deal. Let us reenumerate the instruments that must be watched:

Bank-and-turn indicator.
Air speed indicator.
Compass.
Altimeter.
Rate-of-climb indicator.

Of course one does not have to rivet his eyes on any but the first two, but from these he can scarcely let his vision stray for a moment. And such moments, when seized, must be long enough to allow a glance at not only the other instruments mentioned but at engine thermometers, oil and gasoline gauges, and tachometers. If he is depending on the radio beacon for navigation he is relieved of watching his compass; but if flying by compass he has a navigational problem added to that of merely flying the ship to harass him.

We know that men can do this sort of flying; some of them are doing it. How safely it can be done is a matter of debate. Some individuals are better qualified for it than others; unquestionably to do it properly requires a thorough understanding of the purpose and function of each instrument and continual practice in their use. Lieut. L. C. Ramsey, instructor in aerial navigation at the Pensacola Naval Air Station and a proponent of instrument flying, makes this statement in a recent and very illuminating contribution on the subject:[3]

> It requires from three to six hours instruction or practice in this art before proficiency is gained. Some, with less aptitude for this kind of flying, require longer. Once confidence and proficiency are gained they must be maintained by frequent practice. Even a short lay-off results in a decrease in skill.

Dichman in his informative book, "This Aviation Business," expresses the following view:

> To say that the problem is solved or nearly so is indicative of ignorance. Self-appointed heralds with only unbounded enthusiasm to guide them may announce that with the radiobeacon, induction compass, bank and turn indicator, radio phone to the ground, capacity altimeter, and other equipment the problems of safe fog flying are solved. However, men like Hegenberger and Doolittle, who are doing the pioneer work in this phase of aviation, will readily admit that there are still a great many problems to be solved before flying through a fog can really be considered safe and sure. (P. 145.)

Commander J. C. Hunsaker, vice president of the Goodyear-Zeppelin Corporation, in a very thoughtful paper on "Transoceanic Air Travel," presented at the recent national aeronautic meeting of the Society of Automotive Engineers summarized the situation in these words:

> The effect of thick weather (rain, snow, fog) in inducing loss of control due to loss of visibility is extremely serious, although there is a general expectation that so-called "blind flying" by the use of instruments for control and radio for course and position will eventually overcome this hazard. To-day, we can only say that it is expected that in the future the airplane pilot will be independent of visibility. There will be, however, a necessity for special and delicate instruments, upon the correct functioning of which apparatus the lives of all on board will depend. Bearing in mind the inherent perversity of all delicate instruments, we must conclude that loss of visibility will continue to be dangerous for the airplane.

Discussion of this subject could easily and perhaps very profitably be extended, but the opinions offered should be sufficient to convince the airways meteorologist that for the present at least, and probably for some time to come, his greatest responsibility to the cause of air travel can be best discharged by alert and intelligent advice regarding atmospheric conditions likely to require blind flying, or flying by instrumental means alone. He should not be induced to minimize the cloud or fog hazard wherever safety of flight as distinguished from sheer practicability is the point to be considered, nor be misled by the abortive doctrine that "terminal weather" is the *fons et origo* of an airways weather service. On the contrary, he should apply to every part of the flying zone under his professional purview the purport of Clarence Chamberlain's recently broadcast ultimatum: "When I can't see, I don't fly."

[3] The Distinction Between Blind Flying and Instrument Flying, by L. C. Ramsey, U. S. Air Services, April, 1930, p. 26.

SPECIAL SERIES OF SOUNDING-BALLOON OBSERVATIONS MADE DURING THE WINTER OF 1927–28

By LEROY T. SAMUELS

[Weather Bureau, Washington, 1930]

Table 1 contains a summary of the results obtained from sounding balloons released from 12 selected Weather Bureau stations located in the southern and southwestern sections of the country. In addition to these there were 101 kite flights made at frequent intervals during the same periods at the 5 aerological stations and 38 airplane observations at 5 Naval Air Stations. The kite and airplane data, however, are not published at this time, owing to lack of space, but are available at the central office of the Weather Bureau. It is planned to publish the results of a detailed study of all these observations as soon as practicable.

Table 2 contains the tabulated data for the sounding-balloon observations.

TABLE 1.—*Summary of sounding-balloon observations*

DECEMBER, 1927

Station	Date	Time of release, 75th mer.	Stratosphere: Height of base, meters, M. S. L.	Stratosphere: Temperature at base	Maximum height reached, meters, M. S. L.	Minimum temperature recorded	Meteorograph found at—
				°C.		°C.	
Columbia, Mo.	30	8:00 p.	10,200	−54.0	10,200	−54.0	Colchester, Ill.
	31	7:40 a.			6,548	−44.4	East Hardin, Ill.
Denver, Colo.	30	8:10 p.			9,659	−48.8	Galatia, Colo.
	31	8:00 a.			10,682	−53.5	Haswell, Colo.
Fort Worth, Tex.	30	8:00 p.	Record obliterated				Alba, Tex.
	31	8:00 a.	Not returned				
Los Angeles, Calif.	30	8:21 p.	Not returned				
	31	7:58 a.	Not returned				
Memphis, Tenn.	30	8:16 p.	Not returned				
	31	7:50 a.	Not returned				
Montgomery, Ala.	30	8:01 p.	13,382	−61.3	15,173	−61.8	Stony Creek, Va.
	31	8:00 a.	11,250	−61.2	18,255	−61.2	Athens, Ga.
Nashville, Tenn.	30	8:35 p.			1,746	6.7	Hendersonville, Tenn.
	31	8:12 a.			3,835	−9.0	Martha, Tenn.
New Orleans, La.	30	8:35 p.	12,585	−65.1	12,830	−65.4	Tyson, Ala.
	31	8:07 a.			8,434	−36.2	Bay Minette, Ala.
Oklahoma City, Okla.	30	8:12 p.	14,917	−63.1	16,183	−64.2	Wagoner, Okla.
	31	8:55 a.	Not returned				
Roswell, N. Mex.	30	7:54 p.			5,086	−17.3	Lovington, N. Mex.
	31	7:52 a.	14,888	−75.1	15,952	−75.1	Mertzon, Tex.
San Antonio, Tex.	30	8:18 p.			2,100	6.3	San Antonio, Tex.
	31	8:09 a.	Not returned				
Vicksburg, Miss.	30	7:58 p.	Record obliterated				Vicksburg, Miss.
	31	7:59 a.	10,600	−57.7	10,600	−57.7	Ethelsville, Ala.

FEBRUARY, 1928

Station	Date	Time of release, 75th mer.	Stratosphere: Height of base, meters, M. S. L.	Stratosphere: Temperature at base	Maximum height reached, meters, M. S. L.	Minimum temperature recorded	Meteorograph found at—
				°C.		°C.	
Columbia, Mo.	15	8:00 p.	8,736	−62.1	13,827	−62.1	Silex, Mo.
	16	8:00 a.			9,606	−48.8	Bellflower, Mo.
	16	7:56 p.	Record obliterated				Nebo, Ill.
Denver, Colo.	15	7:52 p.	Not returned				
	16	8:00 a.			2,488	−20.9	Elizabeth, Colo.
	16	7:49 p.	Not returned				
Fort Worth, Tex.	15	8:00 p.	Record obliterated				Genoa, Ark.
	16	8:00 a.			5,247	−16.3	Allen, Tex.
	16	8:00 p.	Record obliterated				Irving, Tex.
Los Angeles, Calif.	15	8:06 p.	Record obliterated				Tijuana, Mex.
	16	8:22 a.			10,069	−55.9	Tecate, Calif.
	16	7:47 p.			8,130	−41.8	San Clemente Island, Calif.
Memphis, Tenn.	15	8:24 p.	Record obliterated				Nunnelly, Tenn.
	16	7:50 a.	Not returned				
	16	7:56 p.	Not returned				
Montgomery, Ala.	15	8:00 p.	Not returned				
	16	8:03 a.	13,155	−66.0	18,129	−63.4	Deepstep, Ga.
	16	8:00 p.			10,424	−47.6	Mayesville, S. C.
Nashville, Tenn.	15	8:09 p.			5,803	−32.8	Mount Juliet, Tenn.
	16	7:55 a.			6,250	−31.5	Silver Springs, Tenn.
	16	8:19 p.			1,473	−6.3	Tulip Grove, Tenn.
New Orleans, La.	15	8:03 p.			5,586	−10.4	Long Beach, Miss.
	16	7:43 a.			7,039	−18.8	Milton, Fla.
	16	8:02 p.	Not returned				

TABLE 1.—*Summary of sounding-balloon observations*—Continued

FEBRUARY, 1928—Continued

Station	Date	Time of release, 75th mer.	Stratosphere: Height of base, meters, M. S. L.	Stratosphere: Temperature at base	Maximum height reached, meters, M. S. L.	Minimum temperature recorded	Meteorograph found at—
				°C		°C	
Oklahoma City, Okla.	15	8:45 p.			9,507	−51.5	Coweta, Okla.
	16	8:17 a.	7,951	−50.6	13,745	−52.9	Mounds, Okla.
	16	8:30 p.			8,406	−44.5	Bruner, Mo.
Roswell, N. Mex.	15	7:53 p.	Not returned				
	16	7:55 p.	Not returned				
San Antonio, Tex.	15	8:07 p.	14,544	−70.9	14,544	−70.9	Cleveland, Tex.
	16	8:09 a.			8,945	−36.7	Huntsville, Tex.
	16	7:40 p.	Not returned				
Vicksburg, Miss.	15	8:05 p.			10,165	−45.8	Northport, Ala.
	16	8:00 a.	Record obliterated				Columbiana, Ala.
	16	7:59 p.	12,208	−65.2	17,055	−65.2	Gadsden, Ala.

MARCH, 1928

Station	Date	Time of release, 75th mer.	Stratosphere: Height of base, meters, M. S. L.	Stratosphere: Temperature at base	Maximum height reached, meters, M. S. L.	Minimum temperature recorded	Meteorograph found at—
Columbia, Mo.	14	7:58 p.			7,781	−38.1	Troy, Mo.
	15	7:58 a.	11,425	−57.3	15,981	−57.3	Bowling Green, Mo.
Denver, Colo.	14	7:49 p.	9,710	−58.1	15,380	−58.8	Roggen, Colo.
	15	7:49 a.	11,373	−58.1	17,563	−58.1	Denver, Colo.
	15	7:59 p.	9,383	−54.8	17,615	−59.1	Castle Rock, Colo.
Fort Worth, Tex.	14	8:15 p.			8,758	−36.3	Dodd City, Tex.
	15	8:15 a.	Record obliterated				Van Alstyne, Tex.
	15	8:05 p.	Record obliterated				Rowlett, Tex.
Los Angeles, Calif.	14	7:53 p.			8,596	−38.6	San Diego, Calif.
	15	7:49 a.	Not returned				
Memphis, Tenn.	14	8:16 p.	Not returned				
Montgomery, Ala.	14	8:00 p.	10,403	−58.6	11,070	−60.2	Ideal, Ga.
	15	8:00 a.	Not returned				
	15	8:00 p.	16,141	−60.3	19,546	−61.0	Meansville, Ga.
Nashville, Tenn.	14	8:20 p.	Not returned				
	15	8:18 a.	Record obliterated				West Nashville, Tenn.
Oklahoma City, Okla.	14	8:17 p.	Not returned				
	15	8:08 a.	10,905	−56.7	14,663	−57.1	Fairfax, Okla.
	15	8:05 p.	13,349	−56.6	15,643	−59.5	Skiatook, Okla.
Roswell, N. Mex.	14	7:52 p.	15,062	−62.0	20,256	−65.7	Oilton, Tex.
	15	7:54 a.			13,956	−52.4	Cap Rock, N. Mex.
San Antonio, Tex.	14	8:35 p.			6,188	−19.9	Maxwell, Tex.
	15	7:55 a.			4,039	−0.3	Sattler, Tex.
Vicksburg, Miss.	14	7:57 p.	Record obliterated				Union, Miss.

TABLE 2.—*Tabulated data*

COLUMBIA, MO.

[90th Mer.]

DECEMBER 30, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	*°C.*	*°C.*	*P. ct.*	*Mb.*		*M. p. s.*	
7:00	227	985.8	−9.4		93	2.57	n.	7.6	10 Nb., NE. Cold, snowy, stormy night. Clouds moving swiftly from NE at 6:00 p. m. Thought to be same at time of release.
	250	982.9	−9.7						
	500	951.3	−12.8						
	750	920.5	−15.8						
7:03	821	912.0	−16.7	1.23					Superadiabatic.
	1,000	890.8	−13.6						
	1,250	862.0	−9.2						

TABLE 2.—*Tabulated data*—Continued

COLUMBIA, MO.—Continued

[90th Mer.]

DECEMBER 30, 1927—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
7:05	1,299	856.6	−8.3	−1.76					Inversion.
	1,500	834.7	−8.3						
	2,000	782.6	−8.1						
7:12	2,500	734.0	−8.0						
	2,647	720.2	−8.0	−0.02					
	3,000	688.1	−9.6						Inversion.
	3,500	644.8	−11.8						
	4,000	604.2	−14.0						
7:19	4,082	597.6	−14.4	0.45					
	4,500	565.9	−17.5						
	5,000	529.2	−21.3						
7:25	5,134	519.3	−22.3	0.75					
	6,000	461.1	−29.2						
7:33	6,362	438.3	−32.0	0.79					
7:37	6,762	414.2	−36.6	1.15					
	7,000	400.2	−37.0						Superadiabatic.
7:42	7,546	369.8	−38.0	0.18					
	8,000	346.4	−41.0						
7:48	8,575	318.3	−44.8	0.66					
	9,000		−47.2						
	10,000		−52.9						
7:59	10,200		−54.0	0.57					Base of stratosphere.

DECEMBER 31, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
6:40	227	994.9	−17.0		73	1.01	nw.	7.6	10 Nb., W.
	250	991.4	−17.3						
	500	958.3	−20.5						
6:44	723	930.4	−23.3	1.27					Superadiabatic.
	750	927.2	−22.6						
	1,000	897.0	−16.5						
	1,250	867.7	−10.3						
6:48	1,343	857.1	−8.0	−2.46					
	1,500	839.8	−9.0						Inversion.
	2,000	787.0	−12.1						
	2,500	737.0	−15.3						
6:54	2,516	735.5	−15.4	0.63					
	3,000	689.8	−18.8						
6:58	3,295	662.6	−20.8	0.69					
	3,500	644.7	−22.2						
	4,000	602.1	−25.5						
	4,500	562.0	−28.9						
	5,000	524.0	−32.2						
7:09	5,208	508.5	−33.6	0.67					
	6,000	453.9	−40.0						
7:23	6,548	419.1	−44.4	0.81					

DENVER, COLO.

[105th Mer.]

DECEMBER 30, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
6:10	1,610	836.4	−14.0		89	1.63	nne.	3.6	10 Nb., N.
6:11	1,747	821.4	−16.4	1.75					Superadiabatic.
	2,000	794.0	−17.1						Light snow falling.
6:13	2,135	780.0	−17.5	0.28					
6:14	2,375	755.6	−13.5	−1.67					
	2,500	743.1	−13.8						Inversion.
6:15	2,610	732.6	−14.0	0.21					
	3,000	695.7	−16.7						
	3,500	650.5	−20.2						
6:21	3,601	641.7	−20.7	0.70					
	4,000	607.7	−24.0						
6:25	4,346	579.8	−26.7	0.78					
	4,500	567.7	−26.7						
6:29	4,991	530.2	−26.7	0.00					
	5,000	529.6	−26.8						Isothermal.
	6,000	461.8	−33.2						
	7,000	399.3	−39.8						
6:45	7,360	378.1	−42.1	0.65					
	8,000	343.6	−46.2						
6:58	8,548	316.5	−49.7	0.64					
	9,000	295.8	−49.3						
7:16	9,659	267.5	−48.8	−0.08					Inversion.

TABLE 2.—*Tabulated data*—Continued

DENVER, COLO.—Continued

[105th Mer.]

DECEMBER 31, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
6:00	1,610	841.8	−21.6		71	0.63	ene.	2.2	3 St., W.
	2,000	798.3	−23.7		71	0.52			
6:03	2,357	760.0	−25.6	0.54	71	0.43			
	2,500	745.4	−23.6		71	0.53			
6:04	2,634	731.6	−21.8	−1.37	71	0.62			
	3,000	696.0	−22.6		71	0.58			Inversion.
	3,500	650.0	−23.7		71	0.52			
	4,000	607.2	−24.8		71	0.46			
6:09	4,075	600.9	−25.0	0.22	71	0.45			
	4,500	567.1	−26.1		71	0.40			
	5,000	529.4	−27.3		71	0.36			
6:14	5,733	477.7	−29.2	0.25	71	0.30			
	6,000	459.7	−30.9		71	0.25			
6:15	6,054	456.5	−31.2	0.62	71	0.24			Relative humidity record probably inaccurate; pen seems to have stuck.
	7,000	399.4	−33.2		71	0.19			
6:20	7,218	387.3	−33.7	0.21	71	0.18			
	8,000	345.8	−39.8		71	0.09			
	9,000	298.0	−47.6		71	0.04			
6:26	9,018	297.4	−47.7	0.78	71	0.04			
	10,000	256.1	−53.1		71	0.02			
6:31	10,082	253.0	−53.5	0.54	71	0.02			

MONTGOMERY, ALA.

[90th mer.]

DECEMBER 30, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
7:01	68	1002.7	18.9		81	17.70	s.	5.8	10 St. Cu., S.
	250	981.5	17.8		86	17.54			
7:03	439	960.2	16.6	0.62	92	17.39			
	500	953.3	16.3		91	16.87			
7:04	735	927.5	15.2	0.47	85	14.69			
	750	925.8	15.2		86	14.86			
7:05	914	908.2	15.1	0.06	91	15.62			
	1,000	899.3	14.8		89	14.99			Isothermal.
	1,250	873.2	13.8		82	12.94			
7:06	1,276	870.2	13.7	0.39	81	12.70			
	1,500	847.7	12.4		84	12.10			
	2,000	798.3	9.5		90	10.68			
7:10	2,040	794.4	9.3	0.58	91	10.65			
	2,500	751.3	6.2		71	6.73			
7:12	2,701	733.1	4.8	0.68	62	5.21			
	3,000	707.3	3.2		63	4.84			
	3,500	664.6	0.4		64	4.03			
7:18	3,846	636.4	−1.5	0.55	65	3.51			
	4,000	624.3	−2.5		65	3.23			
	4,500	586.4	−5.7		67	2.55			
	5,000	550.3	−8.9		69	1.99			
7:25	5,414	521.5	−11.5	0.64	70	1.60			
	6,000	483.8	−14.9		71	1.20			
	7,000	423.2	−20.7		72	0.71			
7:32	7,257	408.7	−22.2	0.58	72	0.60			
	8,000	368.8	−27.6		72	0.35			
	9,000	321.3	−34.8		72	0.17			
7:39	9,061	318.5	−35.2	0.72	72	0.15			
	10,000	278.9	−42.6		71	0.07			
7:45	10,513	258.5	−46.7	0.79	70	0.04			
	11,000	240.5	−49.2		69	0.03			
	12,000	206.5	−54.3		67	0.02			
	13,000	177.3	−59.4		66	0.01			
7:57	13,382	167.3	−61.3	0.51	65	0.01			
	14,000	152.1	−61.5		63	0.01			Base of stratosphere.
	15,000	130.0	−61.8		60				
8:08	15,173	126.3	−61.8	0.03	60				

DECEMBER 31, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:00	68	1,000.2	16.1		89	16.29	sw.	2.2	9 St., W.
	250	979.0	16.1		72	13.36	wnw.	7.6	
	500	950.6	16.1		50	9.15	nw.	16.7	
7:03	612	938.2	16.1	0.00	40	7.32	nw.	21.0	Isothermal
	750	922.7	15.1		45	7.68	nw.	21.2	
	1,000	895.6	12.9		53	7.89	wnw.	22.2	
	1,250	869.2	10.9		62	8.08	wnw.	21.5	
	1,500	843.6	8.9		70	7.98	wnw.	17.4	

TABLE 2.—*Tabulated data*—Continued

MONTGOMERY, ALA.—Continued

[90th mer.]

DECEMBER 31, 1927—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:09	1,926	801.8	5.4	0.81	85	7.62	w.	17.4	
	2,000	794.7	5.3		84	7.48			
7:11	2,500	747.5	4.4		73	6.10			
	2,601	738.4	4.2	0.18	75	6.19			
7:16	3,000	703.0	1.6		80	5.49			
	3,500	660.7	−1.3		87	4.78			
7:18	3,718	643.1	−2.6	0.58	90	4.44			
	4,000	620.3	−3.3		70	3.26			
	4,136	609.9	−3.7	0.26	60	2.70			
	4,500	582.6	−6.8		67	2.32			
7:24	5,000	546.4	−11.1		76	1.81			
7:25	5,475	513.3	−15.1	0.85	85	1.40			
	5,738	495.8	−14.9	−0.08	65	1.10			
	6,000	478.9	−17.0		64	0.89			Inversion.
7:32	7,000	419.5	−24.8		61	0.40			
	7,524	390.2	−28.9	0.78	60	0.26			
	8,000	365.2	−33.2		59	0.16			
7:37	9,000	316.7	−42.2		56	0.05			
	9,187	308.1	−43.9	0.90	55	0.04			Adiabatic.
	9,950	274.8	−55.1	1.47	50	0.01			Adiabatic.
	10,000	272.7	−55.3		53	0.01			
7:50	11,000	233.9	−60.0		50				
	11,250	224.8	−61.2	0.47	50				
	12,000	198.5	−61.0		50				Base of stratosphere.
	13,000	167.7	−60.8		50				
	14,000	142.0	−60.5		50				
	15,000	120.1	−60.3		50				
	16,000	102.9	−60.0		50				
	17,000	89.0	−59.8		50				
	18,000	77.6	−59.6		50				
8:14	18,255	75.2	−59.5	−0.02	50				

NASHVILLE, TENN.

[90th mer.]

DECEMBER 30, 1927

P. m.									
7:35	191	988.4	15.3		88	15.30	s.	8.9	10 St. Cu., S.
	250	981.8	14.8		89	14.99			
7:38	500	952.7	12.7		94	13.81			
7:39	525	950.1	12.5	0.84	95	13.78			
	579	943.9	13.2	−1.29	80	12.14			Inversion.
	750	924.6	12.2		76	10.80			
	1,000	897.4	10.9		69	9.00			
	1,250	871.3	9.5		63	7.48			
	1,500	845.2	8.1		56	6.05			
7:52	1,746	820.5	6.7	0.56	50	4.90			

DECEMBER 31, 1927

A. m.									
7:12	191	989.5	1.8		94	6.53	nw.	12.5	10 St. Cu., NW.
	250	982.3	1.5		94	6.40			
	500	951.9	0.0		96	5.87			
	750	923.0	−1.5		97	5.24			
	1,000	894.6	−3.0		99	4.72			
7:16	1,155	877.0	−3.9	0.59	100	4.42			
	1,250	866.6	−3.4		100	4.61			
	1,500	840.2	−2.0		100	5.18			
7:18	1,548	834.8	−1.7		100	5.31			
7:19	1,678	821.6	1.8	−0.56	100	6.26			Inversion.
	2,000	789.3	2.6	−2.69	90	5.96			Inversion.
7:20	2,044	785.0	2.7		81	5.94			
	2,500	741.8	−0.2	−0.25	80	4.69			Inversion.
	3,000	696.6	−3.3		78	3.49			
7:25	3,024	694.6	−3.5		75	3.44			
	3,500	653.7	−6.7	0.63	75	2.09			
7:29	3,835	626.3	−9.0		60	1.43			
				0.68	50				

NEW ORLEANS, LA.

[90th mer.]

DECEMBER 30, 1927

P. m.									
7:35	17	1,008.8	21.5		94	24.12	s.	2.2	10 St., SW.
7:36	234	983.8	20.4	0.51	96	23.02			
	250	981.8	20.3		96	22.88			
	500	953.7	18.8		92	19.97			
	750	926.3	17.2		88	17.27			
	1,000	899.8	15.7		85	15.16			

TABLE 2.—*Tabulated data*—Continued

NEW ORLEANS, LA.—Continued

[90th mer.]

DECEMBER 30, 1927—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:40	1,190	880.0	14.5	0.62	82	13.54			
	1,250	873.6	14.1		81	13.03			
	1,500	848.2	12.6		79	11.53			
	2,000	799.0	9.6		73	8.72			
7:45	2,297	771.1	7.8	0.61	70	7.41			
	2,500	752.6	7.5		69	6.12			
7:46	2,653	738.8	7.2	0.17	50	5.08			
	3,000	708.1	4.3		50	4.15			
7:50	3,484	667.0	0.3	0.83	50	3.12			
	3,500	665.5	0.2		49	3.04			
	4,000	625.6	−2.4		26	1.30			
7:52	4,014	624.5	−2.5	0.53	25	1.24			
7:53	4,312	601.4	−2.6	0.03	22	1.08			
	4,500	587.2	−4.6		21	0.88			Isothermal.
	5,000	551.0	−10.0		17	0.45			
7:57	5,013	550.1	−10.1	1.07	17	0.44			Superadiabatic.
7:58	5,425	522.0	−11.1	0.24	17	0.40			
	6,000	483.8	−15.7		16	0.25			
8:04	6,559	449.7	−20.1	0.79	15	0.15			
	7,000	424.0	−23.6		15	0.11			
8:08	7,581	391.9	−28.2	0.79	16	0.07			
	8,000	369.3	−33.2		15	0.04			
8:13	8,198	359.1	−35.5	1.18	14	0.03			Superadiabatic.
8:14	8,484	344.6	−35.4	−0.03	16	0.03			Inversion.
	9,000	320.4	−39.5		17	0.02			
	10,000	277.6	−47.4		18	0.01			
8:20	10,152	271.5	−48.6	0.79	18	0.01			
	11,000	239.5	−54.3		18				
8:26	11,028	238.1	−54.5	0.67	18				
	12,000	204.8	−60.5		18				
8:31	12,035	203.8	−60.7	0.62	18				
8:35	12,585	187.4	−65.1	0.80	18				
8:36	12,830	180.0	−65.4	0.12	18				Base of stratosphere.

DECEMBER 31, 1927

A. m.									
7:07	17	1,011.5	14.8		75	12.63	nw.	3.1	2 St. Cu., W.; 4 A. St., W.
7:10	250	984.2	13.1		71	10.71	nnw.	9.4	
	458	960.0	11.6	0.72	67	9.15	nnw.	12.3	
	500	955.2	11.9		65	9.05	nnw.	12.7	
	750	927.0	13.8		50	7.89	nw.	13.6	
7:12	837	917.6	14.4	−0.74	45	7.38	nw.	13.6	Inversion.
	1,000	899.6	13.3		45	6.88	nw.	13.8	
	1,250	873.4	11.6		45	6.15	wnw.	15.2	
	1,500	847.9	9.9		45	5.49	wnw.	18.6	
7:18	1,936	804.5	6.9	0.68	45	4.48	w.	22.4	
	2,000	798.2	6.6		45	4.38	w.	22.6	
	2,500	750.6	3.9		43	3.47	wsw.	22.3	
7:22	2,698	732.8	2.8	0.54	42	3.14	wsw.	24.0	
	3,000	705.8	2.5		38	2.78	wsw.	27.2	
7:25	3,179	690.4	2.4	0.08	35	2.54	wsw.	29.3	Isothermal.
	3,500	663.2	−0.1		32	1.94	wsw.	30.0	
	4,000	623.2	−4.1		27	1.17	wsw.	31.2	
7:30	4,216	606.4	−5.8	0.79	25	0.94	wsw.	28.2	
	4,500	585.0	−6.8		24	0.83	wsw.	32.0	
7:33	4,629	575.5	−7.2	0.34	24	0.80	wsw.	30.0	
	5,000	548.8	−9.8		23	0.61	wsw.	30.8	
	6,000	481.5	−17.0		20	0.28			
7:44	6,093	475.8	−17.6	0.71	20	0.26			
7:51	6,827	431.1	−24.8	0.98	19	0.12			
	7,000	421.0	−25.1		19	0.12			Adiabatic.
7:52	7,013	420.1	−25.1	0.16	19	0.12			
	8,000	367.3	−32.9		27	0.08			
8:10	8,434	345.0	−36.2	0.79	30	0.06			

OKLAHOMA CITY, OKLA.

[90th mer.]

DECEMBER 30, 1927

P. m.									
7:12	385	974.6	−10.0		87	2.28	n.	9.8	10 St., N.
	500	959.7	−11.2						
7:14	750	928.7	−14.0						
	985	900.9	−16.5	1.08					Superadiabatic.
	1,000	898.6	−16.5						
7:15	1,250	869.4	−16.8						
	1,326	860.9	−16.9	0.12					
7:16	1,500	841.4	−12.5						
	1,702	819.7	−7.4	−2.53					Inversion.
7:18	2,000	789.0	−5.8						
	2,380	751.9	−3.8	−0.53					Inversion.
	2,500	740.3	−4.5						
	3,000	695.0	−7.7						
	3,500	651.5	−10.8						

TABLE 2.—*Tabulated data*—Continued

OKLAHOMA CITY, OKLA.—Continued

[90th mer.]

DECEMBER 30, 1927—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M. p. s.*	
7:23	3,568	645.8	−11.2	0.62					
	4,000	610.2	−14.9						
	4,500	570.7	−19.2						
7:26	4,651	559.2	−20.5	0.86					
7:29	5,000	533.3	−24.3						
	5,416	503.8	−28.9	1.10					
	6,000	464.6	−33.0						
7:35	6,702	420.0	−37.9	0.70					Superadiabatic.
	7,000	401.9	−39.3						
	8,000	346.9	−43.8						
7:41	8,375	328.3	−45.6	0.45					
	9,000	299.0	−48.5						
7:46	9,548	275.7	−51.1	0.46					
	10,000	257.6	−50.4						
7:49	10,144	252.1	−50.2	−0.15					
	11,000	221.2	−51.3						
7:56	11,581	202.3	−52.0	0.13					Inversion.
	12,000	189.8	−53.4						
	13,000	162.9	−56.7						
	14,000	138.9	−60.0						
8:17	14,917	120.0	−63.1	0.33					
	15,000	118.5	−63.2						Base of stratosphere.
	16,000	101.0	−64.0						
8:29	16,183	97.9	−64.2	0.09					

ROSWELL, N. MEX.

[105th mer.]

DECEMBER 30, 1927

Time									
P. m.									
5:54	1,098	888.2	9.6		21	2.51	nw.	8.5	1 st. cu., NW.
	1,250	872.0	8.7						
	1,500	845.7	7.2						
5:59	1,763	819.3	5.7	0.59					Strong NW. wind prevailed during entire time balloon was aloft.
6:04	2,000	795.6	3.6						
	2,382	759.0	0.2	0.89					
6:08	2,500	747.8	−1.0						
	2,965	705.4	−5.7	1.01					
	3,000	702.2	−5.9						Superadiabatic.
	3,500	658.4	−9.0						
6:15	3,979	618.8	−11.9	0.61					
6:19	4,000	617.1	−11.8						
	4,225	599.6	−11.2	−0.29					
	4,500	578.5	−14.4						Inversion.
	5,000	541.8	−16.7						
6:32	5,086	535.4	−17.3	0.71					

DECEMBER 31, 1927

Time									
A. m.									
5:52	1,098	900.0	−8.3		82	2.49	n.	1.8	2 ci. st., W.
	1,250	882.2	−9.3		83	2.31			
	1,500	854.2	−10.9		84	2.03			
5:54	1,572	846.4	−11.4	0.65	84	1.94			
5:55	1,756	826.5	−7.8	−1.96	84	2.66			Inversion.
	2,000	800.8	−8.4		80	2.41			
5:56	2,133	787.3	−8.8	0.27	78	2.27			
	2,500	750.4	−10.6		76	1.88			
5:58	2,575	743.4	−11.0	0.50	75	1.86			
	3,000	703.2	−11.0		71	1.70			
6:00	3,075	696.5	−11.0	0.00	70	1.68			
	3,500	659.0	−13.0		69	1.38			Isothermal.
	4,000	617.7	−15.3		67	1.09			
	4,500	578.8	−17.7		66	0.86			
	5,000	540.7	−20.0		64	0.67			
6:07	5,173	527.5	−20.8	0.47	64	0.62			
	6,000	471.0	−26.3		63	0.35			
6.12	6,503	439.6	−29.7	0.67	62	0.25			
	7,000	409.6	−33.8		62	0.16			
6:18	7,787	365.9	−40.2	0.82	62	0.07			
	8,000	354.7	−42.0		62	0.06			
	9,000	305.9	−50.4		62	0.02			
6:24	9,048	303.8	−50.8	0.84	62	0.02			
	10,000	262.1	−56.9		58	0.01			
6:28	10,087	258.6	−57.5	0.65	58	0.01			
6:31	10,712	234.7	−60.8	0.53	58	0.01			
	11,000	224.3	−61.4		58	0.01			
	12,000	191.1	−63.4		58	0.01			
6:40	12,495	176.7	−64.4	0.20	57				
	13,000	163.0	−66.7		57				
	14,000	139.0	−71.1		57				
6:53	14,888	120.2	−75.1	0.45	57				
	15,000	118.0	−74.8		57				Base of stratosphere.
7:06	15,952	100.3	−72.6	−0.23	59				

TABLE 2.—*Tabulated data*—Continued

SAN ANTONIO, TEX.

[90th mer.]

DECEMBER 30, 1927

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M. p. s.*	
7:18	230	984.9	20.4		36	8.63	nw.	2.2	Cloudless.
	250	982.4	20.5		35	8.44			
7:19	430	962.4	21.3	−0.45	30	7.60			Inversion.
	500	954.6	20.7		30	7.33			
	750	977.0	18.7		29	6.26			
	1,000	900.3	16.7		29	5.52			
7:26	1,215	877.9	14.9	0.81	28	4.75			
	1,250	874.0	14.5		29	4.79			
	1,500	848.3	12.0		33	4.63			
7:32	1,719	826.8	9.8	1.01	36	4.36			
7:40	2,000	799.2	7.2		35	3.56			Superadiabatic.
	2,100	789.6	6.3	0.92	35	3.34			Adiabatic.

VICKSBURG, MISS.

[90th mer.]

DECEMBER 31, 1927

Time									
A. m.									
6:59	75	1,007.8	6.2		86	8.15	nw.	6.7	10 st., NW.
	250	985.9	4.9		88	7.62			
	500	956.0	3.2		90	6.91			
7:02	750	927.2	1.4		93	6.29			
	980	901.3	−0.3	0.72	95	5.66			
	1,000	899.1	−0.1		94	5.70			
	1,250	871.5	1.8		82	5.70			
	1,500	845.0	3.7		71	5.65			
7:04	1,512	843.9	3.8	−0.77	70	5.61			
	2,000	794.3	3.5		70	5.50			Inversion.
7:08	2,493	747.9	3.1	0.07	70	5.32			Isothermal.
	2,500	747.2	3.0		70	5.31			
	3,000	702.4	−2.0		72	3.73			
7:11	3,282	677.8	−4.8	1.00	73	2.99			Adiabatic.
	3,500	659.3	−4.4		68	2.88			
7:14	3,865	629.5	−3.6	−0.21	60	2.72			Inversion.
	4,000	618.9	−4.6		58	2.42			
7:18	4,500	580.8	−8.4		53	1.60			
	4,891	551.9	−11.4	0.76	48	1.11			
7:22	5,000	544.2	−12.3		48	1.02			
	5,880	484.6	−19.3	0.80	46	0.52			
7:23	6,000	476.9	−18.9		46	0.53			
	6,171	466.0	−18.3	−0.34	46	0.57			
7:29	7,000	416.7	−25.9		46	0.27			Inversion.
	7,601	383.3	−31.4	0.92	46	0.15			Adiabatic.
	8,000	363.1	−35.3		46	0.10			
	9,000	314.9	−44.9		46	0.03			
7:39	9,792	278.8	−52.6	0.97	46	0.01			
7:43	10,000		−53.9						Adiabatic.
	10,600		−57.7	0.63					Base of stratosphere.

COLUMBIA, MO.

[90th mer.]

FEBRUARY 15, 1928

Time									
P. m.									
7:00	227	987.1	0.0		72	4.40	nw.	1.3	Cloudless.
	250	984.2	−0.2		72	4.33			
	500	953.1	−2.8		73	3.54			
	750	923.0	−5.3		74	2.91			
	1,000	894.1	−7.8		74	2.35			
7:03	1,246	867.0	−10.3	1.01	75	1.69			
	1,250	866.5	−10.3		75	1.69			Superadiabatic.
7:04	1,414	848.4	−9.7	−0.36	62	1.67			Inversion.
	1,500	839.0	−10.2		63	1.62			
	2,000	785.8	−13.4		66	1.27			
	2,500	735.8	−16.6		69	0.99			
7:07	2,516	734.3	−16.7	0.63	69	0.99			
7:09	2,933	694.9	−16.7	0.00	62	0.89			
	3,000	688.5	−17.2		62	0.84			Isothermal.
	3,500	643.8	−20.9		61	0.59			
	4,000	601.2	−24.5		61	0.41			
7:13	4,389	570.2	−27.4	0.74	60	0.30			
	4,500	561.6	−28.2		60	0.27			
	5,000	524.2	−32.0		62	0.19			
7:18	5,821	465.8	−38.2	0.75	65	0.10			
	6,000	454.3	−39.7		65	0.08			
7:23	7,000	392.2	−48.1		65	0.03			
7:27	7,166	382.2	−49.5	0.84	65	0.03			
	7,894	341.5	−56.7	0.99	60	0.01			
	8,000	335.8	−57.4		61	0.01			
7:30	8,736	299.6	−62.1	0.64	65	0.01			Adiabatic.
	9,000	288.0	−61.8		63	0.01			
	10,000	246.5	−60.5		55	0.01			Base of stratosphere.
7:40	10,702	219.2	−59.6	−0.13	50	0.01			
	11,000	209.2	−59.5		51	0.01			
	12,000	178.8	−59.3		53	0.01			
7:47	12,605	162.7	−59.2	−0.02	55	0.01			
	13,000	153.0	−59.6		55	0.01			
7:54	13,827	134.0	−60.3	0.09	55				

TABLE 2.—*Tabulated data*—Continued

COLUMBIA, MO.—Continued

[90th mer.]

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
7:00	227	988.5	−3.0		92	4.39	nw.	2.7	3 Ci. St., SW.
	250	985.4	−3.0		91	4.34			
7:01	476	957.8	−3.0	0.00	83	3.96			Isothermal.
	500	955.0	−3.2		83	3.89			
	750	925.3	−4.7		85	3.52			
7:02	994	896.9	−6.3	0.64	86	3.10			
	1,000	896.2	−6.3		86	3.10			
	1,250	868.1	−6.4		71	2.54			
	1,500	840.7	−6.5		57	2.02			
7:05	1,784	810.9	−6.6	0.04	41	1.44			Isothermal.
	2,000	788.8	−7.6		45	1.45			
	2,500	739.6	−10.0		55	1.44			
	3,000	693.2	−12.3		64	1.36			
7:09	3,312	664.9	−13.8	0.47	70	1.30			
	3,500	648.7	−15.0		70	1.17			
	4,000	607.7	−18.1		72	0.90			
	4,500	568.1	−21.3		73	0.67			
7:15	4,895	538.3	−23.8	0.63	74	0.53			
	5,000	530.4	−24.7		74	0.49			
	6,000	461.2	−33.6		70	0.18			
7:20	6,191	449.1	−35.3	0.89	69	0.14			
	7,000	400.3	−42.6		70	0.06			
7:23	7,061	396.5	−43.2	0.91	70	0.06			Adiabatic.
7:26	7,936	347.6	−50.6	0.85	68	0.03			
	8,000	344.3	−50.7		67	0.02			
7:30	8,867	302.1	−51.4	0.09	60	0.02			Isothermal.
	9,000	296.5	−50.9		60	0.02			
7:32	9,606	270.3	−48.8	−0.35	58	0.02			Inversion.

DENVER, COLO.

[105th mer.]

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
6:00	1,610	837.4	−15.7		69	1.08	s.	4.0	Cloudless.
	2,000	795.1	−17.3		70	0.94			
6:01	2,027	792.3	−17.4	0.41	70	0.94			
6:03	2,488	744.6	−20.9	0.76	70	0.67			

FORT WORTH, TEX.

[90th mer.]

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:00	204	990.7	9.0		42	4.82	se.	2.7	10 St. Cu., SE.
	250	984.8	8.6						
	500	954.8	6.5						
	750	927.0	4.4						
7:02	899	910.2	3.2	0.83					
	1,000	898.9	3.9						
7:02	1,102	887.8	4.6	−0.69					Inversion.
	1,250	872.3	3.9						
	1,500	845.8	2.8						
7:06	1,842	810.2	1.2	0.46					
	2,000	794.3	1.7						
7:07	2,047	790.0	1.9	−0.34					Inversion.
	2,500	746.5	−0.5						
7:10	2,881	711.7	−2.6	0.54					
	3,000	701.0	−2.5						
7:11	3,040	697.6	−2.5	−0.06					Inversion.
	3,500	658.8	−5.4						
	4,000	618.2	−8.6						
7:17	4,102	609.5	−9.2	0.63					
	4,500	578.9	−14.7						
7:24	4,601	570.8	−16.1	1.38					Superadiabatic.
	5,000	541.7	−16.2						
7:32	5,247	524.1	−16.3	0.03					Isothermal.

LOS ANGELES, CALIF.

[120th mer.]

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
5:22	127	1,010.5	6.0		39	3.65	ne.	1.8	Cloudless.
	250	995.2	6.7		38	3.73			
5:23	444	972.1	7.9	−0.60	37	3.94			Inversion.
	500	965.3	7.7		36	3.78			
5:24	731	938.9	7.0	0.31	32	3.21			
	750	936.3	6.9		32	3.18			
	1,000	908.2	5.5		32	2.89			
	1,250	880.7	4.2		31	2.56			
	1,500	854.3	2.8		31	2.32			

TABLE 2.—*Tabulated data*—Continued

LOS ANGELES, CALIF.—Continued

[120th mer.]

FEBRUARY 16, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
5:27	1,756	827.8	1.4	0.55	31	2.10			
	2,000	803.6	0.0		31	1.89			
	2,500	754.2	−3.0		31	1.48			
5:29	2,572	747.5	−3.4	0.59	31	1.43			
	3,000	708.2	−4.7		31	1.28			
	3,500	664.2	−6.1		30	1.10			
5:34	3,592	656.6	−6.4	0.29	30	1.07			
	4,000	622.9	−9.4		30	0.83			
	4,500	583.9	−13.0		30	0.60			
5:39	4,875	555.9	−15.8	0.73	30	0.46			
	5,000	547.0	−16.9		30	0.42			
5:43	5,885	485.6	−24.6	0.87	30	0.20			
	6,000	478.0	−25.6						
	7,000	415.1	−35.6						
5:50	7,103	409.4	−35.5	0.90					Adiabatic.
5:52	7,392	393.2	−34.8	−0.24					Inversion.
	8,000	360.2	−39.9						
5:59	8,367	341.7	−43.0	0.84					
	9,000	311.1	−48.7						
6:09	9,475	289.6	−53.0	0.90					Adiabatic.
	10,000	267.1	−55.6						
6:19	10,069	264.5	−55.9	0.49					

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:47	127	1,010.7	17.5		33	6.60	sse.	1.3	Few Ci. St., NW.
	250	996.3	16.5		33	6.20	se.	1.0	
	500	967.4	14.5		33	5.45	se.	0.4	
	750	939.4	12.6		33	4.81	w.	1.0	
4:49	857	927.1	11.7	0.79	33	4.54	wnw.	1.4	
	1,000	911.3	10.4		32	4.04	wnw.	2.1	
	1,250	884.0	8.3		30	3.29	wnw.	3.0	
	1,500	857.4	6.1		29	2.73	wnw.	3.4	
4:52	1,725	834.3	4.1	0.88	27	2.21	w.	3.7	
	2,000	806.5	2.3		28	2.02	wsw.	2.4	
	2,500	757.9	−1.0		30	1.69	ne.	7.1	
	3,000	711.9	−4.3		32	1.37	ne.	16.0	
4:58	3,299	685.4	−6.3	0.66	33	1.19	ne.	19.7	
	3,500	668.4	−5.8		31	1.17	ne.	21.6	
5:00	3,667	654.4	−5.3	−0.27	30	1.18	ne.	23.7	Inversion.
	4,000	627.5	−7.1		30	1.01	ne.	22.8	
	4,500	588.3	−9.8		30	0.80	nne.	22.7	
5:06	4,672	574.9	−10.7	0.54	30	0.74	nne.	21.6	
	5,000	550.8	−13.6		29	0.55	nne.	23.8	
5:12	5,558	511.6	−18.5	0.88	27	0.32	nne.	26.0	
	6,000	482.1	−22.1		26	0.22	nne.	26.6	
5:19	6,566	446.5	−26.7	0.81	24	0.13	nne.	23.6	
	7,000	420.9	−31.5		23	0.08	nne.	24.0	
5:25	7,259	405.5	−34.3	1.10	22	0.05	nne.	24.0	Superadiabatic.
	8,000	365.5	−40.3		21	0.03			
5:36	8,188	355.0	−41.8	0.81	21	0.02			

MONTGOMERY, ALA.

(90th mer.)

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:08	68	1,007.7	5.3		92	8.20	nw.	1.8	2 Ci. St., W.; 2 St. N.
	250	985.2	3.8		93	7.46			
	500	955.3	1.6		94	6.45			
	750	926.5	−0.5		96	5.63			
	1,000	898.0	−2.6		97	4.78			
7:13	1,215	973.7	−4.4	0.85	98	4.15			
	1,250	869.7	−4.0		96	4.21			
	1,500	842.7	−1.5		79	4.27			
7:14	1,590	833.4	−0.6	−1.01	73	4.24			Inversion.
	2,000	792.6	−3.0		68	3.24			
7:17	2,267	765.4	−4.6	0.59	65	2.71			
	2,500	743.3	−4.7		60	2.48			
7:19	2,838	711.7	−4.9	0.05	52	2.12			Isothermal.
	3,000	697.2	−6.0		51	1.89			
	3,500	654.2	−9.5		48	1.32			
	4,000	613.0	−13.0		46	0.92			
7:23	4,127	603.0	−13.9	0.70	45	0.83			
	4,500	573.3	−15.4		40	0.64			
7:24	4,521	571.9	−15.5	0.41	40	0.64			
	5,000	536.2	−19.0		39	0.45			
7:29	5,838	479.9	−25.1	0.73	38	0.24			
	6,000	469.4	−25.2		39	0.25			
	7,000	408.9	−25.5		44	0.27			
7:33	7,127	402.0	−25.5	0.03	45	0.27			
	8,000	355.9	−33.5		45	0.12			

TABLE 2.—*Tabulated data*—Continued

MONTGOMERY, ALA.—Continued

[90th mer.]

FEBRUARY 16, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
7:40	8,824	316.5	−41.1	0.92	45	0.05			Adiabatic.
	9,000	308.6	−42.4		45	0.04			
	10,000	265.8	−49.8		45	0.02			
7:45	10,181	258.5	−51.1	0.74	45	0.01			
	11,000	228.2	−57.3		46	0.01			
7:50	11,275	218.9	−58.5	0.68	46	0.01			
	12,000	195.2	−61.4		44				
	13,000	166.3	−65.4		42				
7:58	13,155	162.4	−66.0	0.40	42				Base of stratosphere.
	14,000	142.3	−65.6		43				
	15,000	122.2	−65.0		43				
	16,000	104.5	−64.5		44				
	17,000	89.3	−64.0		45				
	18,000	74.9	−63.5		46				
8:29	18,129	73.1	−63.4	−0.05	46	0.01			

FEBRUARY 16, 1928

P. m.									
7:00	68	1,006.0	12.0		53	7.44	se.	1.3	10 A. St., W.
	250	984.0	10.7		53	6.82			
	500	955.0	9.0		53	6.08			
	750	926.5	7.3		53	5.42			
7:03	1,003	898.6	5.5	0.70	53	4.79			
	1,250	872.3	6.8		48	4.74			
	1,500	846.8	8.2		44	4.78			
7:06	1,800	815.9	9.8	−0.54	38	4.61			Inversion.
	2,000	796.0	8.6		37	4.13			
	2,500	747.5	5.7		34	3.11			
	3,000	703.0	2.7		31	2.30			
7:11	3,447	666.7	0.1	0.59	28	1.72			
	3,500	662.5	−0.3		28	1.67			
	4,000	622.9	−4.1		33	1.44			
	4,580	584.9	−7.9		37	1.17			
	5,000	547.2	−11.7		41	0.92			
7:17	5,121	538.7	−12.6	0.76	42	0.87			
7:18	5,489	513.7	−11.8	−0.22	30	0.67			Inversion.
	6,000	480.5	−15.7		30	0.47			
7:22	6,373	457.5	−18.6	0.77	30	0.36			
7:24	6,665	440.0	−19.9	0.45	32	0.34			
	7,000	421.0	−21.9		31	0.27			
7:29	7,920	371.1	−27.2	0.58	30	0.15			
	8,000	367.0	−27.9		30	0.14			
	9,000	319.1	−36.2		30	0.06			
7:34	9,139	313.0	−37.4	0.84	30	0.05			
	10,000	277.3	−44.2		30	0.02			
7:39	10,424	259.1	−47.6	0.79	30	0.02			

NASHVILLE, TENN.

[90th mer.]

FEBRUARY 15, 1928

P. m.									
7:09	191	995.4	7.0		64	6.41	w.	1.3	10 St., Cu., SW.
	250	988.1	6.3						
	500	957.8	3.5						
	750	928.7	0.6						
	1,000	900.2	−2.3						
7:12	1,062	893.6	−3.0	1.15					Superadiabatic.
7:15	1,241	873.6	−4.0	0.56					
	1,250	872.5	−4.1						
	1,500	845.5	−5.9						
	2,000	793.3	−9.3						
7:16	2,453	747.5	−13.1	0.75					
	2,500	742.8	−13.0						
7:17	2,642	729.4	−12.7	−0.21					Inversion.
7:18	2,851	709.6	−14.2	0.72					
	3,000	695.9	−14.3						
7:19	3,491	652.4	−14.5	0.05					Isothermal.
	3,500	651.6	−14.6						
	4,000	610.4	−18.6						
	4,500	570.3	−22.6						
7:23	4,756	550.3	−24.7	0.81					
	5,000	532.0	−26.6						
7:26	5,803	476.0	−32.8	0.77					

FEBRUARY 16, 1928

A. m.									
6:55	191	995.4	4.0		78	6.34	nw.	3.6	10 St. Cu., NW.
	250	988.3	3.5						
	500	957.7	1.2						
6:56	715	932.7	−0.7	0.99					Adiabatic.
	750	928.3	−1.0						
	1,000	899.8	−3.3						
	1,250	871.8	−5.5						

TABLE 2.—*Tabulated data*—Continued

NASHVILLE, TENN.—Continued

[90th mer.]

FEBRUARY 16, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
6:58	1,379	857.4	−6.7	0.90					Adiabatic.
	1,500	844.7	−5.2						
6:59	1,662	827.2	−3.1	−1.27					Inversion.
	2,000	793.3	−4.0						
	2,500	744.8	−5.3						
	3,000	698.4	−6.7						
7:03	3,085	690.5	−6.9	0.27					
	3,500	654.0	−10.3						
7:05	3,880	622.8	−13.5	0.83					
	4,000	613.0	−14.1						
7:06	4,359	584.8	−15.8	0.48					
	4,500	574.2	−16.8						
	5,000	537.0	−20.3						
7:08	5,327	513.9	−22.6	0.70					
	6,000	469.1	−29.1						
7:10	6,250	452.2	−31.5	0.96					Adiabatic.

FEBRUARY 16, 1928

P. m.									
7:19	191	995.1	7.6		58	6.06	ne.	2.2	2 Ci. St., W.
	250	988.0	6.9		58	5.77			
	500	958.3	3.7		59	4.70			
7:21	732	931.1	0.8	1.25	60	3.88			Superadiabatic.
	750	929.1	0.6		60	3.83			
	1,000	900.6	−1.8		61	3.21			
	1,250	872.5	−4.2		63	2.72			
7:24	1,473	847.9	−6.3	0.96	64	2.31			Adiabatic.

NEW ORLEANS, LA.

[90th mer.]

FEBRUARY 15, 1928

P. m.									
7:03	17	1,010.5	7.8		88	9.31	ne.	3.6	10 St., NE.
	250	982.1	5.4		93	8.34			
7:05	353	969.9	4.3	1.04	95	7.88			Light rain falling.
	500	952.9	6.3		90	8.59			
	750	924.3	9.8		80	9.70			
7:06	756	923.7	9.9	−1.39	80	9.76			Inversion.
	1,000	896.9	8.8		84	9.51			
	1,250	870.4	7.7		89	9.35			
7:08	1,328	862.0	7.3	0.45	90	9.20			
	1,500	844.5	8.0		90	9.66			
7:10	1,633	830.9	8.5	−0.39	90	9.99			Inversion.
	2,000	794.3	7.2		78	7.92			
	2,500	747.9	5.5		61	5.51			
7:15	2,845	716.9	4.3	0.35	50	4.15			
	3,000	703.7	3.7		66	5.25			
7:17	3,036	700.4	3.6	0.37	70	5.53			
7:18	3,189	687.3	4.3	−0.46	48	3.98			Inversion.
	3,500	660.8	2.1		59	4.19			
	4,000	621.1	−1.5		76	4.10			
7:23	4,247	602.7	−3.3	0.72	85	3.95			
	4,500	583.6	−4.6		72	3.00			
	5,000	548.5	−7.3		47	1.56			
7:38	5,586	508.6	−10.4	0.53	17	0.43			

FEBRUARY 16, 1928

A. m.									
6.43	17	1,012.9	7.2		89	9.04	ne.	3.6	10 St., NE.
	250	984.5	5.5		94	8.49			
6.45	447	961.2	4.1	0.72	98	8.03			
	500	954.8	4.8		96	8.26			
	750	926.0	7.9		89	9.48			
6.46	832	917.2	8.9	−1.25	87	9.92			
	1,000	898.9	8.8		82	9.28			
	1,250	873.0	8.6		75	8.38			
	1,500	847.5	8.4		68	7.49			
	2,000	798.0	8.0		53	5.69			
6.52	2,479	751.6	7.7	0.07	39	4.10			Isothermal.
	2,500	749.7	7.5		39	4.04			
	3,000	704.9	3.5		34	2.67			
	3,500	662.9	−0.5		28	1.64			
6.57	3,619	653.1	−1.4	0.80	27	1.47			
	4,000	671.9	−4.1		28	1.22			
	4,500	584.0	−7.8		30	0.95			
7.00	4,603	576.4	−8.5	0.72	30	0.90			
	5,000	547.8	−9.3		38	1.06			
7.02	5,050	544.4	−9.4	0.20	39	1.08			
7.05	5,911	486.6	−16.5	0.82	58	0.84			
	6,000	481.1	−16.4		56	0.82			
7.09	6,594	444.5	−15.8	−0.10	45	0.70			Inversion.
	7,000	421.2	−18.5		42	0.50			
7.12	7,039	419.3	−18.8	0.67	42	0.49			

TABLE 2.—*Tabulated data*—Continued

OKLAHOMA CITY, OKLA.

[90th mer.]

FEBRUARY 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7.45	385	970.0	5.6		97	8.82	se.	2.7	10 St., SE.
	500	956.4	4.8		97	8.34			
	750	927.2	3.0		98	7.43			Light rain falling.
	1,000	899.0	1.2		99	6.59			
	1,250	871.5	−0.6		100	5.81			
7.49	1,379	855.8	−1.6	0.71	100	5.36			
	1,500	844.9	−2.2		100	5.10			
	2,000	793.0	−4.9		100	4.07			
	2,500	744.5	−7.7		100	3.20			
7:53	2,659	729.1	−8.6	0.55	100	2.96			
	3,000	696.8	−10.7		100	2.46			
	3,500	651.9	−13.7		100	1.88			
	4,000	611.0	−16.8		100	1.41			
7:59	4,133	601.1	−17.6	0.61	100	1.31			
	4,500	572.7	−20.6		98	0.97			
	5,000	535.0	−24.8		96	0.62			
8.03	5,279	514.9	−27.1	0.83	95	0.49			
	6,000	465.8	−32.6		89	0.26			
8:08	6,540	431.6	−36.7	0.76	85	0.15			
	7,000	404.3	−41.7		81	0.08			
8:14	7,756	361.3	−49.8	1.08	75	0.03			
	8,000	348.2	−50.3		73	0.03			Superadiabatic.
8:18	8,548	320.4	−51.5	0.21	70	0.02			
	9,000	300.0	−50.6		69	0.02			
8:24	9,507	277.1	−49.5	−0.21	68	0.03			Inversion.

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
8:07	[1] 13,745	145.9	−52.3	−0.03					
	13,000	164.0	−52.5						10 St., NE.
	12,000	191.1	−52.8						
8:11	11,452	207.5	−52.9	0.10					
	11,000	222.2	−52.5						
	10,000	258.7	−51.5						
8:14	9,496	279.3	−51.0	0.03					
	9,000	302.5	−50.9						
	8,000	350.8	−50.6						
8:18	7,951	353.4	−50.6	0.55					
8:19	7,458	379.9	−47.9	1.76					Base of stratosphere.
8:21	7,014	405.7	−40.1	0.98					Superadiabatic.
	7,000	406.5	−40.0						Adiabatic.
8:23	6,286	450.0	−33.0	0.85					
	6,000	468.0	−30.6						
	5,000	537.4	−22.2						
8:27	4,639	564.7	−19.1	0.76					
	4,500	574.8	−18.1						
	4,000	614.5	−14.3						
8:30	3,500	655.3	−10.5						
8:31	3,277	675.0	−8.8	−0.20					
	3,030	697.1	−9.3	0.67					Inversion.
	3,000	700.1	−9.1						
8:32	2,500	746.3	−5.8						
8:33	2,400	755.6	−5.1	−0.51					
	2,205	774.6	−6.1	0.42					Inversion.
	2,000	795.3	−5.2						
8:35	1,516	845.4	−3.2	−0.59					
	1,500	847.0	−3.3						Inversion.
	1,250	874.5	−4.8						
8:36	1,230	876.5	−4.9	0.65					
	1,000	902.2	−3.4						
	750	930.7	−1.8						
	500	960.9	−0.1						
8:38	385	974.9	0.6		85	5.42	ne.	5.4	

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
7:30	385	974.4	−1.6		95	5.09	n.	2.7	10 St., N.
	500	960.5	−2.9						Snowing.
7:32	659	941.2	−4.6	1.10					Superadiabatic.
	750	930.3	−5.2						
	1,000	901.2	−6.9						
7:35	1,033	897.4	−7.1	0.67					
	1,250	873.0	−6.9						
	1,500	845.2	−6.6						
7:37	1,603	834.3	−6.5	−0.11					
	2,000	792.0	−8.4						Inversion.
	2,500	724.7	−10.7						
7:43	2,839	711.3	−12.3	0.47					
	3,000	697.3	−13.1						
	3,500	654.0	−15.5						
7:49	3,896	618.6	−17.4	0.48					
	4,000	610.0	−18.0						
	4,500	570.9	−20.9						

[1] Descent used instead of ascent.

TABLE 2.—*Tabulated data*—Continued

OKLAHOMA CITY, OKLA.—Continued

[90th mer.]

FEBRUARY 16, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:54	4,834	545.2	−22.8	0.58					
	5,000	533.2	−24.2						
	6,000	464.5	−32.4						
8:00	6,264	447.0	−34.6	0.83					
	7,000		−39.9						
8:05	7,454		−43.2	0.72					
8:07	7,930		−44.5	0.27					
	8,000		−44.4						
8:09	8,406		−43.6	−0.19					Inversion.

SAN ANTONIO, TEX.

[90th mer.]

FEBRUARY 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
7:07	230	985.5	15.4		63	11.02	se.	2.2	2 Ci. St. SW.
	250	983.5	15.3		63	10.96			
	500	955.0	13.5		65	10.06			
	750	927.0	11.7		66	9.08			
	1,000	899.5	9.9		67	8.17			
7:10	1,250	872.2	8.1		69	7.45			
	1,273	870.0	7.9	0.72	69	7.35			
7:11	1,500	846.6	9.5		63	7.48			
	1,509	845.7	9.6	−0.72	63	7.53			Inversion.
	2,000	796.1	7.0		58	5.81			
	2,500	749.3	4.4		52	4.35			
7:17	3,000	705.5	1.8		47	3.27			
	3,347	675.4	0.0	0.52	43	2.63			
	3,500	662.8	−1.1		42	2.34			
	4,000	622.6	−4.6		41	1.71			
	4,500	584.2	−8.2		39	1.20			
7:24	5,000	547.6	−11.7		37	0.83			
	5,609	505.5	−16.1	0.71	35	0.53			
7:27	6,000	480.3	−15.2		35	0.57			
	6,485	450.6	−14.1	0.23	35	0.63			
	7,000	421.0	−17.5		35	0.46			
	8,000	367.7	−24.0		36	0.26			
7:33	8,198	357.8	−25.3	0.65	36	0.22			
	9,000	320.1	−33.2		35	0.09			
7:40	9,597	294.8	−39.0	0.98	35	0.05			
	10,000	278.1	−43.8		35	0.03			Adiabatic.
7:44	10,398	262.3	−48.5	1.18	35	0.02			Superadiabatic.
	11,000	239.6	−54.5		33	0.01			
7:48	11,248	230.3	−57.0	1.00	32	0.01			Adiabatic.
	12,000		−60.2		33				
	13,000		−64.4		34				
	14,000		−68.6		35				
8:04	14,544		−70.9	0.42	36				Base of stratosphere.

FEBRUARY 16, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:09	230	986.9	9.9		86	10.49	ne.	3.6	10 St. NE.
	250	984.4	9.7		87	10.47			
	500	955.1	7.6		94	9.81			
7:10	546	950.0	7.2	0.86	95	9.65			
7:11	741	927.9	8.6	−0.72	90	10.05			Inversion.
	750	976.8	8.5		90	9.99			
	1,000	899.7	6.9		95	9.45			
	1,250	872.9	5.3		99	8.82			
7:13	1,281	868.9	5.1	0.65	100	8.78			
	1,500	846.2	7.4		77	7.93			
7:14	1,666	829.1	9.1	−1.04	60	6.94			
	2,000	795.6	7.3		61	6.23			Inversion.
	2,500	749.1	4.7		62	5.29			
7:16	2,516	747.7	4.6	0.53	62	5.26			
7:17	2,669	734.0	5.0	−0.26	65	5.67			
	3,000	705.0	2.6		62	4.56			Inversion.
	3,500	663.0	−1.0		57	3.21			
	4,000	622.3	−4.6		52	2.17			
7:24	4,449	587.3	−7.8	0.72	48	1.52			
	4,500	583.4	−8.2		48	1.47			
	5,000	547.8	−12.0		47	1.03			
7:29	5,990	480.4	−19.5	0.76	44	0.48			
	6,000	479.7	−19.5		44	0.48			
7:30	6,169	468.7	−19.2	−0.17	44	0.50			
7:33	6,703	436.3	−23.3	0.77	44	0.33			Inversion.
	7,000	419.6	−22.9		44	0.35			
7:36	7,424	395.4	−22.4	−0.12	44	0.37			
	8,000	365.6	−27.8		44	0.21			Inversion.
7:45	8,945	320.3	−36.7	0.94	44	0.08			Adiabatic.

TABLE 2.—*Tabulated data*—Continued

VICKSBURG, MISS.

[90th mer.]

FEBRUARY 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:05	75	1,006.0	5.1		81	7.11	ne.	1.8	Few St., NE.
	250	984.9	3.8						
	500	955.2	2.1						
	750	926.0	−0.3						
7:08	910	907.2	−0.9	0.72					
	1,000	897.2	0.0						
7:09	1,239	870.8	2.4	−1.00					Inversion.
	1,250	869.7	2.4						
7:10	1,410	852.6	1.8	0.35					
	1,500	843.1	2.3						
7:11	1,752	817.5	3.8	−0.58					Inversion.
	2,000	793.0	2.5						
	2,500	745.0	−0.2						
	3,000	699.8	−2.9						
7:16	3,127	688.8	−3.6	0.54					
7:17	3,369	668.0	−2.9	−0.29					Inversion.
	3,500	657.2	−3.9						
	4,000	616.8	−7.7						
7:20	4,410	584.8	−10.8	0.76					
	4,500	577.9	−11.4						
	5,000	540.8	−14.8						
7:25	5,795	487.2	−20.3	0.69					
	6,000	473.9	−20.3						
7:27	6,186	462.1	−20.3	0.00					Isothermal.
7:28	6,419	447.9	−21.9	0.69					
	7,000	414.3	−23.3						
7:31	7,446	389.9	−24.3	0.23					
	8,000	361.0	−28.7						
7:38	8,543	334.8	−33.1	0.80					
	9,000	336.6	−36.6						
7:39	9,055	311.0	−37.0	0.76					
7:47	9,954	273.1	−44.3	0.81					
	10,000	271.1	−44.6						
7:49	10,165	264.9	−45.8	0.71					

FEBRUARY 16, 1928

P. m.									
6:59	75	1,005.7	10.2		60	7.46	ne.	2.2	4 Ci. St. SW.
	250	984.7	9.0		60	6.89			
	500	955.4	7.3		61	6.23			
	750	926.9	5.6		61	5.54			
	1,000	898.6	3.9		62	5.00			
7:03	1,137	883.8	3.0	0.68	62	4.70			
	1,250	871.8	3.6		64	5.06			
	1,500	845.3	5.1		67	5.88			
7:04	1,503	845.0	5.1	−0.57	67	5.88			Inversion.
	2,000	795.2	2.6		62	4.56			
	2,500	747.0	0.0		56	3.42			
7:08	2,590	738.6	−0.4	0.51	55	3.25			
7:09	2,940	707.1	−0.2	−0.06	45	2.70			Inversion.
	3,000	702.1	−0.6		46	2.67			
	3,500	658.9	−4.1		59	2.57			
7:12	3,807	634.0	−6.2	0.69	66	2.40			
	4,000	618.4	−6.4		60	2.15			
7:14	4,447	584.5	−6.9	0.11	45	1.54			
	4,500	580.4	−7.3		45	1.49			
	5,000	544.3	−10.6		41	1.02			
	6,000	477.3	−17.2		35	4.76			
7:21	6,257	461.2	−18.9	0.66	33	0.38			
7:23	6,809	428.7	−19.9	0.18	35	0.37			
	7,000	417.3	−21.5		34	0.31			
	8,000	364.2	−29.7		31	0.12			
7:29	8,206	353.9	−31.4	0.82	30	0.10			
7:35	8,933	318.9	−43.4	1.66	30	0.02			Superadiabatic.
	9,000	316.0	−43.9		30	0.02			
	10,000	273.9	−49.5		30	0.01			
7:41	10,634	247.8	−53.1	0.56	30	0.01			
	11,000	234.2	−55.9		30	0.01			
	12,000	200.4	−63.6		30				
7:48	12,208	193.9	−65.2	0.77	30				Base of stratosphere.
	13,000	170.2	−64.9		30				
	14,000	144.3	−64.6		30				
	15,000	123.6	−64.3		30				
8:03	15,350	117.5	−64.2	−0.03	30				
	16,000	106.8	−63.9		32				
	17,000	90.5	−63.3		35				
8:26	17,055	89.5	−63.3	−0.05	35				

COLUMBIA, MO.

[90th mer.]

MARCH 14, 1928

P. m.									
6.58	227	993.2	10.0		62	7.62	ne.	2.7	10 A. St., W.
	250	990.5	9.8		62	7.51			
	500	961.4	8.1		64	6.91			
7.00	751	932.2	6.3	0.71	65	6.20			
	1,000	904.5	4.0		67	5.45			
	1,250	877.1	1.6		68	4.66			

TABLE 2.—*Tabulated data*—Continued

COLUMBIA, MO.—Continued

[90th mer.]

MARCH 14, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\,m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7.04	1,476	852.3	−0.5	0.94	70	4.10			Adiabatic.
	1,500	850.0	−0.4		70	4.14			
	1,658	833.4	0.0	−0.27	70	4.28			Inversion.
	2,000	798.7	−2.8		72	3.49			
	2,500	749.5	−7.0		74	2.52			
7.11	2,608	739.0	−7.9	0.83	75	2.36			
7.12	2,793	721.7	−6.6	0.70	75	2.64			Inversion.
	3,000	703.0	−7.4		76	2.50			
7.15	3,105	693.3	−7.8	0.38	77	2.44			
	3,500	659.2	−10.7		78	1.92			
7.18	3,751	637.9	−12.6	0.74	79	1.64			
	4,000	617.6	−12.9		80	1.62			
	4,500	578.6	−14.8		81	1.38			
7.24	4,873	550.5	−15.9	0.29	82	1.26			
	5,000	541.1	−16.7		82	1.17			
7.30	5,979	474.8	−23.1	0.65	85	0.65			
	6,000	473.4	−23.2		83	0.64			
7.37	6,949	415.4	−29.4	0.65	75	0.31			
	7,000	412.3	−34.7		75	0.17			
7.52	7,781	369.6	−38.1	1.04	82	0.13			Superadiabatic.

MARCH 15, 1928

A. m.									
6.58	227	993.6	3.0		70	5.31	ne.	5.4	10 St., NE.
	250	990.7	2.9		70	5.26			
	500	960.6	1.3		72	4.83			
	750	930.8	−0.3		74	4.41			
7.00	887	915.2	−1.2	0.64	75	4.15			
	1,000	902.3	−0.8		74	4.23			
	1,250	875.0	0.2		71	4.40			
7.02	1,399	858.7	0.8	−0.39	70	4.53			Inversion.
	1,500	847.9	0.4		69	4.34			
	2,000	796.7	−1.3		62	3.40			
7.04	2,031	793.6	−1.4	0.35	62	3.37			
	2,500	748.2	−4.7		64	2.69			
7.07	2,868	713.7	−7.3	0.66	65	2.15			
	3,000	701.8	−7.3		66	2.18			
	3,500	658.5	−7.4		71	2.34			
7.11	3,733	638.9	−7.5	0.02	73	2.38			Isothermal.
	4,000	617.2	−8.7		74	2.17			
	4,500	578.8	−10.8		77	1.88			
	5,000	542.1	−13.0		79	1.58			
7.15	5,018	540.9	−13.1	0.44	79	1.57			
	6,000	475.2	−18.2		82	1.02			
7.19	6,133	466.7	−18.9	0.52	82	0.95			
	7,000	415.6	−25.9		84	0.49			
7.22	7,216	403.0	−27.6	0.80	85	0.42			
	8,000	361.3	−32.4		87	0.26			
7.26	8,436	339.7	−35.0	0.61	88	0.19			
	9,000	314.0	−39.4		81	0.11			
7.30	9,806	279.1	−45.8	0.79	72	0.05			
	10,000	271.3	−47.2		72	0.04			
	11,000	232.4	−54.3		74	0.02			
7.35	11,425	217.8	−57.3	0.71	75	0.01			Base of stratosphere.
	12,000	199.7	−57.3		75	0.01			
7.38	12,020	199.2	−57.3	0.00	75	0.01			
	13,000	172.2	−56.4						
	14,000	148.6	−55.4						
	15,000	127.5	−54.4						
8.00	15,981	108.0	−53.5	−0.10					

DENVER, COLO.

[105th mer.]

MARCH 14, 1928

P. m.									
5.49	1,610	828.8	3.7		83	6.61	nw.	2.7	10 St., NW.
5.50	1,985	791.1	0.0	0.99					Adiabatic.
	2,000	789.6	−0.1						Raining.
	2,500	742.2	−3.5						
5.53	2,610	731.5	−4.2	0.67					
	3,000	695.3	−7.2						
	3,500	650.6	−11.0						
	4,000	609.1	−14.7						
	4,500	570.4	−18.5						
	5,000	534.8	−22.3						
	6,000	466.6	−29.9						
	7,000	404.6	−37.4						
	8,000	349.7	−45.0						
	9,000	301.3	−52.6						
6.18	9,710	270.9	−58.1	0.76					Base of stratosphere.
	10,000	259.2	−57.6						
	11,000	226.3	−55.8						
6.24	11,401	214.3	−55.1	−0.18					
	12,000	197.4	−55.7						
	13,000	170.8	−56.6						
	14,000	146.2	−57.5						
	15,000	123.8	−58.4						
6.41	15,380	115.5	−58.8	0.09					

TABLE 2.—*Tabulated data*—Continued

DENVER, COLO.—Continued

[105th mer.]

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
5.49	1,610	836.2	−0.5		86	5.04	ne.	3.1	10 St., NE.
	2,000	796.4	−2.3		88	4.45			
	2,500	747.4	−4.7		90	3.73			Snowing.
	3,000	701.6	−7.0		92	3.13			
	3,500	658.2	−9.4		94	2.59			
	4,000	616.4	−11.7		96	2.16			
5.53	4,054	612.0	−12.0	0.47	96	2.10			
	4,500	577.3	−14.9		97	1.64			
	5,000	540.6	−18.1		98	1.22			
5.57	5,321	517.4	−20.2	0.65	99	1.01			
	6,000	472.7	−24.8		100	0.65			
5.59	6,233	458.0	−26.4	0.68	100	0.56			
6.02	6,926	414.9	−30.4	0.58	100	0.37			
	7,000	410.5	−30.4		100	0.37			
6.03	7,275	395.0	−30.4	0.00	98	0.36			Isothermal.
	8,000	356.6	−37.0		97	0.17			
6.06	8,370	338.5	−40.4	0.91	97	0.12			Adiabatic.
	9,000	309.0	−43.5		97	0.08			
	10,000	266.3	−48.5		97	0.05			
6.12	10,156	259.7	−49.3	0.50	97	0.04			
	11,000	228.0	−55.4		96	0.02			
6.16	11,372	215.5	−58.1	0.72	96	0.01			Base of stratosphere.
	12,000	196.1	−56.7		96	0.02			
	13,000	168.4	−54.4		95	0.02			
	14,000	144.0	−52.0		95	0.03			
6.24	14,329	136.5	−51.3	−0.23	95	0.03			
	15,000	122.6	−51.2		94	0.03			
	16,000	105.2	−50.9		91	0.03			
	17,000	90.8	−50.7		89	0.03			
6.34	17,563	83.3	−50.6	−0.02	88	0.04			

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
5:59	1,610	843.7	−5.0		94	3.79	n.	4.0	10 Nb., N.
	2,000	802.5	−7.9						
6:02	2,406	761.6	−11.0	0.75					Snowing.
	2,500	752.3	−11.5						
	3,000	705.2	−14.3						
	3,500	659.9	−17.0						
6:07	3,878	626.8	−19.1	0.55					
	4,000	616.4	−19.7						
	4,500	576.1	−22.4						
6:10	4,774	555.5	−23.8	0.52					
	5,000	539.0	−24.6						
6:14	5,597	496.0	−26.8	0.36					
	6,000	468.9	−31.0						
6:18	6,470	438.4	−35.8	1.03					Superadiabatic.
	7,000	406.3	−37.5						
6:20	7,075	401.9	−37.7	0.31					
	8,000	352.0	−45.4						
6:26	8,377	332.5	−48.6	0.84					
	9,000	302.4	−52.5						
6:30	9,383	285.1	−54.8	0.62					Base of stratosphere.
	10,000	260.1	−52.4						
6:36	10,782	229.9	−49.4	−0.39					
	11,000	222.4	−49.5						Inversion.
	12,000	191.1	−49.8						
6:44	12,485	177.8	−49.9	0.03					
	13,000	164.5	−51.7						Isothermal.
6:52	13,680	148.1	−54.1	0.35					
	14,000	140.7	−54.5						
	15,000	120.1	−55.8						
	16,000	102.4	−57.0						
	17,000	87.5	−58.3						
7:16	17,615	79.9	−59.1	0.13					

FORT WORTH, TEX.

[90th mer.]

MARCH 14, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
7:15	204	983.4	20.0		83	19.42	ne.	5.4	10 St. Cu., SE.
	250	978.3	19.6		82	18.71			
	500	950.0	17.4		75	14.91			
7:17	679	930.6	15.8	0.88	70	12.57			
	750	922.9	15.8		73	13.11			
	1,000	896.6	15.8		86	15.45			
7:19	1,151	880.5	15.8	0.00	93	16.70			Isothermal.
	1,250	870.2	15.2		93	16.07			
	1,500	845.0	13.8		94	14.83			
	2,000	796.2	11.0		96	12.60			
7:22	2,004	795.8	11.0	0.56	96	12.60			
	2,500	750.2	7.6		98	10.23			
7:25	2,987	706.7	4.2	0.69	100	8.25			
	3,000	705.8	4.2		99	8.17			
	3,500	663.7	4.5		46	3.87			

TABLE 2.—*Tabulated data*—Continued

FORT WORTH, TEX.—Continued

[90th mer.]

MARCH 14, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P. ct.*	*Mb.*		*M.p.s.*	
7:27	3,581	656.8	4.5	−0.05	38	3.20			Inversion.
	4,000	623.4	1.0		39	2.56			
	4,500	585.8	−3.1		40	1.89			
7:33	4,765	566.9	−5.3	0.83	40	1.57			
	5,000	550.1	−7.3		41	1.36			
7:36	5,315	528.6	−10.1	0.87	43	1.12			
	6,000	484.2	−14.9		34	0.57			
7:45	6,693	441.3	−19.7	0.70	25	0.28			
	7,000	423.8	−22.1		24	0.20			
7:54	7,862	376.9	−29.0	0.80	23	0.10			
	8,000	370.0	−30.1		24	0.09			
8:00	8,758	332.6	−36.3	0.81	28	0.05			

LOS ANGELES, CALIF.

[120th mer.]

MARCH 14, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
4:53	127	1,002.0	17.3		70	13.83	sw.	3.6	Few Cu., NW
	250	987.5	16.9				wsw.	3.4	
	500	959.0	16.0				w.	2.9	
	750	931.2	15.1				wnw.	3.6	
4:56	893	915.5	14.6	0.35			wnw.	5.0	
	1,000	904.3	14.0				wnw.	6.4	
	1,250	877.6	12.7				nw.	10.3	
	1,500	851.8	11.4				nw.	14.8	
4:58	1,689	832.7	10.3	0.53			nnw.	16.3	
4:59	1,859	816.1	10.8	−0.29			nnw.	17.6	Inversion.
	2,000	802.4	10.1				nnw.	17.5	
	2,500	755.5	7.5				nnw.	20.6	
	3,000	710.6	5.0				nnw.	16.6	
5:05	3,057	705.6	4.7	0.51			nnw.	16.2	
	3,500	668.3	1.5				nnw.	19.0	
	4,000	628.3	−2.0				nnw.	21.0	
5:13	4,365	600.0	−4.6	0.71			nw.	22.5	
	4,500	589.7	−5.6				nw.	25.0	
	5,000	552.9	−9.3				nw.	28.1	
5:20	5,780	499.8	−15.0	0.73			nw.	34.4	
	6,000	485.4	−16.7				nw.	31.2	
	7,000	424.6	−24.7				nw.	33.8	
5:30	7,092	419.2	−25.4	0.79			nw.	33.6	
	8,000	370.1	−32.3						
5:42	8,346	352.4	−34.9	0.76					
5:48	8,596	340.6	−38.6	1.48					Superadiabatic.

MONTGOMERY, ALA.

[90th mer.]

MARCH 14, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100 \text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
7:00	68	1,007.2	19.0		65	14.29	n.	4.9	4 Ci., W.; 2 A. St., W.
	250	986.1	18.3						
	500	957.6	15.2						
7:02	535	953.6	14.9	0.88					
	750	929.8	14.2						
	1,000	902.7	13.5						
	1,250	876.2	12.7						
7:05	1,409	859.9	12.2	0.31					
	1,500	850.8	11.5						
	2,000	801.4	7.9						
7:10	2,312	771.1	5.6	0.73					
7:11	2,455	757.6	6.8	−0.84					Inversion.
	2,500	753.7	6.5						
	3,000	709.3	3.1						
7:18	3,495	666.8	−0.2	0.67					
	3,500	666.4	−0.2						
	4,000	625.9	−4.4						
	4,500	587.2	−8.6						
7:26	4,683	573.1	−10.1	0.83					
	5,000	551.5	−13.1						
7:34	5,665	504.2	−19.4	0.95					Adiabatic.
7:35	5,760	498.0	−18.4	−1.05					Inversion.
	6,000	482.2	20.1						
7:42	6,738	436.5	−25.2	0.70					
	7,000	421.2	−27.7						
7:47	7,432	396.4	−31.8	0.95					Adiabatic.
	8,000	365.9	−37.6						
8:03	8,935	319.8	−47.2	1.02					Superadiabatic.
	9,000	316.6	−47.7						
	10,000	273.2	−55.3						
8:17	10,403	256.4	−58.6	0.78					Base of stratosphere.
	11,000	233.8	−60.0						
8:40	11,070	231.0	−60.2	0.24					

TABLE 2.—*Tabulated data*—Continued

MONTGOMERY, ALA.—Continued

[90th mer.]

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:00	68	1,000.6	23.7		64	18.77	sse.	3.1	8 Cl. St., W.; 2 A. St., W.
	250	980.2	22.9						
	500	953.2	21.8						
7:03	726	927.8	20.8	0.44					
	750	925.9	20.6						
	1,000	899.1	18.8						
7:04	1,118	886.4	17.9	0.74					
	1,250	872.8	17.7						
	1,500	847.3	17.3						
7:06	1,530	844.8	17.2	0.17					
	2,000	799.2	13.5						
	2,500	753.3	9.6						
7:10	2,641	740.5	8.5	0.78					
	3,000	709.2	6.3						
	3,500	667.1	3.1						
7:14	3,747	647.0	1.6	0.62					
	4,000	627.3	1.5						
7:16	4,228	609.8	1.4	0.04					
	4,500	590.0	0.3						
	5,000	555.1	−1.8						
7:22	5,588	514.7	−4.2	0.41					
	6,000	488.3	−6.9						
7:24	6,306	469.7	−8.9	0.65					
7:28	6,893	435.4	−11.6	0.46					
	7,000	429.3	−12.3						
	8,000	376.8	−18.8						
7:36	8,845	335.9	−24.3	0.65					
	9,000	329.0	−25.8						
	10,000	286.9	−35.7						
7:44	10,025	285.8	−36.0	0.99					Adiabatic.
	11,000	249.9	−42.6						
	12,000	215.0	−49.3						
7:52	12,285	205.7	−51.2	0.67					
	13,000	184.7	−51.7						
	13,789	164.0	−52.3	0.07					
	14,000	158.8	−53.0						
	15,000	136.3	−56.4						
	16,000	117.1	−59.8						
8:11	16,141	114.4	−60.3	0.34					Base of stratosphere.
	17,000	99.6	−60.5						
	18,000	85.0	−60.7						
	19,000	73.3	−60.9						
8:30	19,546	67.2	−61.0	0.02					

OKLAHOMA CITY, OKLA.

[90th mer.]

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
7:08	385	962.6	4.8		89	7.65	e.	10.0	10 St., E.
	500	949.2	4.1		90	7.37			
	750	920.3	2.7		91	6.75			
7:09	1,000	892.3	1.2	0.59	93	6.19			
	1,250	865.4	4.2		82	6.76			
	1,500	839.3	7.3		71	7.26			
7:11	1,511	838.2	7.4	−1.21	70	7.21			Inversion.
	2,000	786.7	5.7		82	7.51			
7:13	2,016	788.2	5.6	0.36	82	7.45			
7:14	2,503	742.5	5.4	0.04	70	6.28			
	3,000	698.5	1.4		68	4.60			
	3,500	656.2	−2.6		65	3.20			
7:18	3,569	650.6	−3.1	0.80	65	3.07			
	4,000	615.5	−6.4		66	2.36			
7:20	4,489	578.6	−10.1	0.76	68	1.77			
	4,500	577.7	−10.1		68	1.77			
7:21	4,909	548.1	−11.0	0.21	62	1.49			
	5,000	541.6	−11.8		61	1.36			
7:24	5,717	492.7	−17.9	0.85	50	0.64			
	6,000	474.5	−17.9		47	0.60			
7:25	6,069	470.0	−17.9	0.00	46	0.58			Isothermal.
	7,000	415.2	−25.0		40	0.26			
7:30	7,233	402.0	−26.8	0.76	38	0.20			
	8,000	352.0	−31.7		39	0.12			
7:35	8,729	325.9	−36.4	0.64	39	0.07			
	9,000	313.4	−38.7		39	0.06			
	10,000	270.6	−47.0		39	0.02			
7:39	10,018	270.0	−47.1	0.83	39	0.02			
7:43	10,905	236.3	−56.7	1.08	41	0.01			
	11,000	232.8	−56.7		41	0.01			
	12,000	200.1	−56.8		39	0.01			
	13,000	172.0	−56.9		38	0.01			
	14,000	147.6	−57.0		36	0.01			
7:54	14,663	132.3	−57.1	0.01	35	0.01			

TABLE 2.—*Tabulated data*—Continued

OKLAHOMA CITY, OKLA.—Continued

[90th mer.]

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:05	385	967.5	1.7		95	6.56	n.	5.4	10 St., N.
	500	953.8	1.0						
	750	924.3	−0.4						Light rain falling.
7 06	857	912.3	−1.0	0.57					
	1,000	895.8	−1.4						
	1,250	868.3	−2.0						
7:08	1,280	865.0	−2.1	0.26					
	1,500	841.2	−2.4						
7:10	1,928	797.3	−3.0	0.14					
	2,000	790.2	−3.0						
	2,500	741.7	−3.4						
7:12	2,541	737.9	−3.4	0.07					
	3,000	695.9	−5.6						
7:16	3,455	656.7	−7.7	0.47					
	3,500	653.2	−8.0						
	4,000	612.7	−11.5						
7:19	4,281	590.3	−13.5	0.70					
	4,500	573.6	−16.6						
7:22	4,994	537.0	−18.2	0.66					
	5,000	536.5	−18.2						
	6,000	469.0	−26.4						
7:27	6,031	467.0	−26.7	0.85					
	7,000	407.6	−35.6						
7:33	7,122	400.6	−36.7	0.91					Adiabatic.
7:34	7,365	386.6	−37.0	0.12					
	8,000	353.0	−40.6						
7:42	8,692	319.1	−44.6	0.57					
	9,000	304.9	−43.8						
7:49	9,779	271.9	−41.7	−0.27					Inversion.
	10,000	263.4	−42.2						
7:55	10,986	227.8	−44.6	0.24					
	11,000	227.4	−44.7						
	12,000	195.8	−49.1						
8:03	12,383	184.9	−50.8	−0.44					
	13,000	168.4	−54.5						
8:12	13,349	159.6	−56.6	0.60					Base of stratosphere.
	14,000	144.0	−58.1						
8:17	14,316	137.1	−58.8	0.23					
	15,000	122.4	−59.2						
8:26	15,643	111.4	−59.5	0.05					

ROSWELL, N. MEX.

[105th mer.]

MARCH 14, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\text{ m.}}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m									
5:52	1,098	879.8	16.4		53	9.89	nw.	8.0	1 A St., W.; 8 St. Cu., SW.
	1,250	864.3	14.9		53	8.98			
	1,500	839.1	13.4		53	8.15			
5:54	1,641	825.2	13.2	0.59	53	8.05			
5:56	1,936	796.6	10.5	0.92	53	6.73			Adiabatic.
	2,000	790.7	9.9		53	6.47			
	2,500	744.3	5.2		57	5.04			
5:59	2,835	714.0	2.0	0.95	60	4.23			Adiabatic.
	3,000	699.8	0.9		61	3.98			
	3,500	657.2	−2.6		63	3.11			
6:01	3,558	652.4	−3.0	0.69	63	3.01			
	4,000	616.9	−7.1		64	2.16			
6:04	4,477	579.8	−11.5	0.93	65	1.49			Adiabatic.
	4,500	577.8	−11.7		65	1.46			
	5,000	540.2	−16.3		66	0.98			
6:07	5,575	501.0	−21.6	0.92	67	0.60			Adiabatic.
	6,000	470.4	−25.4		66	0.41			
	7,000	406.5	−34.5		65	0.16			
6:12	7,093	401.1	−35.3	0.90	65	0.14			Adiabatic.
6:15	7,719	367.2	−35.3	0.00	63	0.13			Isothermal.
	8,000	352.7	−37.5		61	0.10			
	9,000	305.0	−45.6		54	0.04			
6:20	9,095	300.7	−46.3	0.80	53	0.03			
	10,000	262.8	−49.4		55	0.02			
6:23	10,514	243.2	−51.2	0.35	56	0.02			
	11,000	225.9	−51.1		56	0.02			
6:26	11,280	216.3	−51.0	−0.03	56	0.02			Inversion.
	12,000	193.5	−52.8		54	0.02			
6:31	12,688	174.4	−54.6	0.26	53	0.01			
	13,000	166.4	−55.6		53	0.01			
	14,000	143.0	−58.7		53	0.01			
	15,000	122.1	−61.8		53	0.01			
6:40	15,052	120.3	−62.0	0.31	53	0.01			Base of stratosphere.
	16,000	103.8	−62.0		53	0.01			
6:42	16,161	101.1	−62.0	0.00	53	0.01			
	17,000	88.3	−64.2		53				
6:46	17,272	84.6	−64.9	0.26	53				
	18,000	75.7	−65.1		55				
	19,000	65.0	−65.4		57				
	20,000	54.8	−65.6		59				
7:10	20,256	52.3	−65.7	0.03	60				

TABLE 2.—*Tabulated data*—Continued

ROSWELL, N. MEX.—Continued

[105th mer.]

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\ m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
5:54	1,098	882.6	7.6		68	7.93	nw.	4.9	6 St. Cu., W.
	1,250	866.3	7.2		68	6.91			
5:55	1,462	844.3	6.6	0.27	68	6.62			
	1,500	840.5	6.2		68	6.45			
	2,000	790.7	1.3		70	4.70			
5:58	2,360	755.8	−2.3	0.99	72	3.64			Adiabatic.
	2,500	742.5	−3.3		73	3.39			
	3,000	697.0	−6.7		76	2.65			
6:01	3,368	664.8	−9.3	0.70	79	2.20			
	3,500	653.8	−9.3		79	2.20			
6:02	3,566	648.0	−9.3	0.00	79	2.20			Isothermal.
	4,000	612.2	−12.7		78	1.61			
	4,500	573.7	−16.7		76	1.09			
6:06	4,949	540.5	−20.3	0.79	75	0.76			
	5,000	536.6	−20.7		75	0.74			
	6,000	468.3	−28.3		74	0.34			
6:10	6,220	454.3	−30.0	0.76	74	0.28			
	7,000	406.6	−38.4		70	0.10			
6:13	7,088	401.3	−39.3	1.07	70	0.10			Superadiabatic.
6:14	7,552	375.2	−39.8	0.11	70	0.09			
	8,000	351.9	−44.6		67	0.05			
6:19	8,134	344.9	−46.1	1.08	66	0.04			Superadiabatic.
	9,000	303.2	−42.9		64	0.06			
6:22	9,515	281.6	−41.0	−0.37	63	0.07			Inversion.
	10,000	262.5	−41.7		63	0.08			
	11,000	226.9	−43.2		64	0.06			
	12,000	195.8	−44.8		65	0.05			
	13,000	168.5	−46.3		66	0.04			
6:32	13,019	168.0	−46.3	0.15	66	0.04			
6:34	13,956	145.7	−52.4	0.65	66	0.02			

SAN ANTONIO, TEX.

[90th mer.]

MARCH 14, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\ m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.									
7:35	230	980.5	24.0		64	19.11	se.	5.8	10 St., NW.
	250	978.2	23.9		64	19.00			
	500	950.5	22.1		68	18.10			
	750	923.6	20.3		72	17.16			

TABLE 2.—*Tabulated data*—Continued

SAN ANTONIO TEX.—Continued

[90th mer.]

MARCH 14, 1928—Continued

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\ m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
P. m.	*M.*	*Mb.*	°*C.*	°*C.*	*P.ct.*	*Mb.*		*M.p.s.*	
7:37	869	911.0	19.4	0.72	74	16.68			
	1,000	897.2	19.1		68	15.04			
7:38	1,135	883.2	18.8	0.23	62	13.46			
	1,250	871.2	18.0		62	12.80			
	1,500	846.0	16.3		61	11.31			
7:41	1,880	809.3	13.6	0.70	60	9.35			
	2,000	797.8	13.6		54	8.41			
7:45	2,352	765.3	13.6	0.00	37	5.76			Isothermal.
	2,500	752.4	12.7		36	5.29			
	3,000	709.2	9.6		30	3.58			
	3,500	667.0	6.5		25	2.42			
7:52	3,546	663.1	6.2	0.62	25	2.37			
	4,000	626.8	1.5		28	1.91			
7:58	4,447	593.2	−3.2	1.04	30	1.41			Superadiabatic.
	4,500	589.4	−3.7		30	1.35			
	5,000	553.4	−8.7		30	0.88			
8:06	5,254	535.1	−11.3	1.00	30	0.70			Adiabatic.
	6,000	485.7	−18.2		28	0.35			
8:14	6,188	473.8	−19.9	0.92	27	0.28			Adiabatic.

MARCH 15, 1928

Time	Altitude, M. S. L.	Pressure	Temperature	$\frac{\Delta t}{100\ m.}$	Humidity: Relative	Humidity: Vapor pressure	Wind: Direction	Wind: Velocity	Remarks
A. m.									
6:55	230	981.4	20.9		90	22.26	se.	4.5	10 St., SE.
	250	979.0	20.7		90	21.99			
6:56	478	953.6	18.8	0.85	95	20.62			
	500	951.0	18.9		95	20.76			
	750	924.2	19.5		93	21.09			
	1,000	897.6	20.1		91	21.42			
6:59	1,150	882.3	20.5	−0.25	90	21.72			Inversion.
	1,250	872.2	20.0		90	21.03			
	1,500	847.5	18.7		90	19.42			
	2,000	799.3	16.1		90	16.47			
	2,500	753.4	13.5		90	13.93			
7:03	2,620	742.9	12.9	0.52	90	13.39			
	3,000	710.4	9.2		90	10.48			
	3,500	668.5	4.4		89	7.44			
7:07	3,666	654.8	2.8	0.96	89	6.65			Adiabatic.
	4,000	628.0	0.0		89	5.44			
7:13	4,039	625.1	−0.3	0.83	89	5.30			

SUPERSATURATION AND ICING OF AIRPLANES

By W. J. HUMPHREYS

[Weather Bureau, Washington, June, 1930]

Aviators have reported occasional instances of very rapid icing of their planes while in flight. Even the term "explosive rapidity" has been used to indicate the apparent suddenness of this phenomenon. It also has been asserted that such exceptionally rapid accumulation is owing to supersaturation in an undercooled cloud with respect to any film of ice that may be on the wings and other portions of the "ship." This sounds learned and also fits the observations perfectly. But before accepting this enticing explanation as necessary and sufficient to account for the alleged facts let us first try on it the touchstone of figures.

Suppose, to be liberal, that the temperature is −10° C., the cloud particles still liquid droplets, and that the plane flying through this cloud has on it a film of ice. What will be the rate of ice accumulation on the front edge of the wings by condensation?

From the Smithsonian Physical Tables, and elsewhere, it appears that at −10° C. the vapor pressure over water is, in terms of the height of a balancing column of mercury, 2.144 millimeters, and over ice 1.964 millimeters, that is, less by 0.180 millimeters. Furthermore, from the same source we find that at −10° C. and in the presence of ice, the weight of vapor necessary to saturate a cubic meter is 2.158 grams. Hence the number of grams of water vapor necessary to add to a cubic meter saturated at −10° C. in the presence of ice, to render it saturated at the same temperature in the presence of only undercooled water is given by the equation

$$\frac{180}{1964} = \frac{x}{2.158}$$

from which x, the amount in question, is .198 grams, nearly. It may be argued that as this applies to water having a flat surface, the standard for saturation determinations, the difference in the presence of droplets only, as in a cloud, would be greater. This is true, but for droplets of this size the difference is negligibly small.

If, then, a plane caught up all the excess, or supersaturation, vapor "encountered" in passing through a cloud undercooled to −10° C. the load would be .198 grams per square centimeter vertical cross section, per

cubic meter swept out by that square centimeter, or, in other words, per each 10 kilometers flight in such cloud. Or, what comes to the same thing, he would have to fly, under these conditions, 72 miles or thereabouts, to accumulate a layer of clear ice an inch thick on the front of the plane. Of course, though, nothing like all the excess vapor encountered would be condensed on the plane. Perhaps not a tenth of it. At any rate, condensation of the excess vapor in an undercooled cloud can not load an airplane with explosionlike rapidity. In fact the amount of icing from this source probably is negligible.

As stated above, the condensation explanation of the icing of airplanes may seem at first to be sound and sufficient, but like many another explanation that has found its way into popular literature (and some, too, that isn't so popular) it was just jumped at—and missed a mile.

RELATIONS BETWEEN WINTERS IN MANITOBA AND THE FOLLOWING SPRING IN EASTERN UNITED STATES

By FRED GROISSMAYR

[Passau, Germany]

In various publications[1] I have given, as I believe, solid bases for a winter temperature forecast in the interior of Canada from the Winnipeg-Lake region to Saskatchewan; further investigations on Canadian seasonal temperature forecasts had given me the interesting result that the winter temperature at Manitoba is a very useful indicator for the immediately following spring on the Great Lakes province and the New England States as well as for a large area bounded in the west by the Mississippi, in the east by the Atlantic, and in the south about by the thirty-fifth parallel of north latitude. For this investigation I used the 50-year series 1874–1923. The correlations are as follows:

Δt I–II Winnipeg 1873–74 with following Δt III–V: 1874–1923.

Winnipeg	0.59	Detroit	0.43
Marquette	**0.63**	New York	0.53
Chicago	0.45	Omaha	0.37
Toronto	0.65	Key West	0.00
Albany	0.47	Cheyenne	0.04
Cincinnati	0.39	Portland, Oreg.	0.08
Eastport	0.49	Mobile	0.26
Nashville	0.29	San Diego	0.02
New Haven	0.58	Galveston	0.05
St. Johns	0.31	San Francisco	0.11

A still better combination, however, is Δt I–II Winnipeg 1874–1923 with Δt III–IV: Winnipeg 0.52.

Low to Westward:		High to Eastward—Con.	
Portland	0.11	New York	0.66
Denver	0.16	Albany	0.64
San Diego	0.05	Baltimore	0.63
Galveston	0.06	Pittsburgh	0.51
High to Eastward:		$r \geqq 0.60$:	
Marquette	0.74	St. Louis	0.49
Toronto	0.73	Omaha	0.47
Chicago	0.60	Nashville	0.35
Boston	0.66	Mobile	0.32
Eastport	0.51	Key West	0.03
New Haven	0.71		

The next table shows the numerical departure of Δt I–II at Winnipeg and those of Δt III–IV, 1874–1923: (1) For Δt III–IV (Marquette and Toronto divided by 2); (2) for Δt III–IV (New York plus New Orleans, plus Cincinnati and Milwaukee divided by 5.

Year	Δt I–II Winnipeg	Δt III–IV Great Lakes	Eastern United States	Year	Δt I–II Winnipeg	Δt III–IV Great Lakes	Eastern United States
1874	−0.5	−4.8	−3.3	1901	−0.2	+1.8	−0.6
1875	**−11.3**	**−5.7**	−4.2	1902	**10.5**	**+4.6**	**+1.6**
				1903	+4.1	+4.8	+3.3
1876	−6.3	−3.0	**−2.1**	1904	−3.9	−2.2	−1.7
1877	+5.5	−1.5	−1.6	1905	−0.3	+0.3	+2.0
1878	**+17.1**	**+9.0**	**+5.8**				
1879	−4.5	−0.1	+0.4	1906	+5.9	+0.1	−1.9
1880	+0.7	−0.6	+0.9	1907	−1.8	−1.0	+0.4
				1908	**+9.8**	**+6.5**	**+3.2**
1881	−2.0	−1.6	−3.0	1909	+0.4	−1.2	−0.4
1882	+3.3	+0.1	+2.0	1910	+3.5	+8.0	+5.5
1883	**−9.6**	**−5.5**	**−1.5**				
1884	**−9.6**	**−2.3**	**−0.8**	1911	−0.3	+1.6	+0.5
1885	**−8.9**	**−8.1**	**−3.5**	1912	−1.0	−2.3	−1.6
				1913	−2.3	+1.0	+0.6
1886	−5.8	+1.1	−0.2	1914	+1.0	−0.6	−1.5
1887	**−9.9**	**−4.0**	**−0.6**	1915	**+9.0**	**+4.8**	**+0.1**
1888	**−7.3**	**−6.3**	**−1.9**				
1889	**+2.2**	**+3.0**	**+1.6**	1916	−1.4	−1.7	−1.8
1890	**−8.1**	**−1.2**	**−1.0**	1917	−5.4	−0.7	−0.3
				1918	−0.1	**+2.8**	**+1.7**
1891	+1.8	−0.3	−0.9	1919	**+9.0**	**+2.4**	**+1.0**
1892	−1.0	−1.7	−2.3	1920	**+2.5**	**+0.1**	−1.0
1893	**−7.8**	**−2.8**	**−0.9**				
1894	−0.5	+4.3	+3.1	1921	**+10.5**	**+6.5**	**+6.0**
1895	−2.3	−1.5	−0.3	1922	**+3.2**	**+3.2**	**+2.0**
				1923	**+2.8**	**−0.7**	**−3.6**
1896	+2.4	+0.1	+0.7				
1897	+1.1	+0.8	+0.8				
1898	+5.9	+4.4	+1.0				
1899	−4.3	−1.2	−1.0				
1900	+2.1	−0.4	−0.8				

We further find the remarkable fact, that in all cases, in which the combined January-February temperature at Winnipeg had a pronounced character (departure 6.0; standard deviation 6.01 F.), the following combined March-April in the Lake region as well as in eastern United States had the same departure. In this 50-year series we have 15 *pronounced* Winnipeg January-February departures that is in 30 per cent. In the table I have indicated these by bold-face type.

The correlations: Δt I–II W. with Δt III–IV Lake area or first group is 0.75. For eastern United States or the second group 0.60.

The regression equations are:

First group Δt III–IV = 0.433 Δt I–II W. F.

Second group Δt III–IV = 0.227 Δt I–II W. F.

It is a noteworthy, but notwithstanding physically founded fact, that even the stations in North Dakota, as well as Winnipeg itself, are much less influenced than the far countries on the Atlantic; even New York's March and April temperatures are much more influenced by the preceding Januaries and Februaries in Manitoba,

[1] Relations between summers in India and winters in Canada, Mo. Wea. Rev. 57: 455–56. See also Neue Erkentnisse im Zusammenhange des Welt-Wetter. Analen der Hydrographie, April, 1930.

than the next environs of Winnipeg. For this fact the physical causes are:

(1) High-temperature constancy between I–II and III–IV in Manitoba.

(2) Prevailing northwest winds in Ontario and New England in the early spring.

(3) The thermic effect of the great fresh-water lakes, therefore, we will consider the relations in a cold winter in Manitoba.

Manitoba I–II severe; III–IV cool also Ontario, Michigan, etc.; I–II generally severe also; III–IV prevailing northwest winds Manitoba-Atlantic bringing cool temperature from the interior; temperature negatively influenced by the over-blown ice masses of the lakes.

SUMMARY

The two generally severest months in Manitoba (January and February) are of enormous influence on the immediately following March-April eastward; the very close connection enables one to give in future two reasonable forecasts for these months for the whole area of the Great Lakes region and New England. The correlation $r = \leqq 0.60$ covers an area about twice the size of Germany.

EDITOR'S NOTE.—In a recent communication Mr. Groissmayr indicates that he has discovered a relation between spring temperature at Dawson, Alaska, and the immediately following summer temperature in the middle Mississippi Valley. He expects to favor readers of the REVIEW with a note on the subject in a few months.—*A. J. H.*

WEATHER ABNORMALITIES IN THE UNITED STATES (SIXTH NOTE): TEMPERATURE DISTRIBUTION

By ALFRED J. HENRY

[Weather Bureau, Washington, June, 1930]

The monthly mean temperature distribution with respect to departures from the normal is shown on Chart III of this REVIEW. The shaded areas represent departures above the normal and the unshaded areas represent departures below the normal.

Anyone who has observed Chart III month by month must have noticed that normal temperature seldom occurs in any month except along a more or less arbitrary line drawn on the chart to separate districts having negative departures from those of opposite sign. The monthly mean temperatures along the zero line or line of no departure from the normal is approximately normal.

It may have been observed also that months when the mean temperature anomaly is in the same sense over the whole country are of rather infrequent occurrence. The most frequent distribution is a mixed one, some areas having a positive departure and others a negative. The purpose of this paper is to explain so far as is possible the occurrence of sharply contrasted anomalies.

The Rocky Mountains as a climatic divide.—The Rocky Mountains at times act as a climatic divide, especially as to temperature, and the reason is not far to seek. It has been established that the flow of polar air equatorward takes place along and near to the surface of the ground, say up to 3,000 to 4,000 feet. Since the summits of the Rocky Mountains are generally at a greater altitude than the above figures and since the cold air generally flows equatorward along the east slope of the mountains the range serves as a barrier to prevent the overflow of cold air to the areas west of the mountains. There are other factors which in connection with the barrier effect operate to keep temperature west of the mountains at a higher level on occasions than air to the east of the mountains. These factors are in the main, the place of origin and direction of movement of cyclonic systems and areas of high pressure (anticyclones); these in turn are controlled by the pressure distribution over large areas remote from the west coast of the North American continent. The lack of adequate meteorological data from the vast water surface between the Asiatic continent and North America makes it difficult to place ones finger upon the controlling cause or causes of origin and any tentative explanation that may be offered must be largely speculative. It is only within very recent years that meteorologists have been able to gain any knowledge of the pressure distribution over the North Pacific.

Consider first the condition *warm east, cold west of the Rockies:* This condition has been found in 6 winter months out of a total of 111 in the last 37 winters; it is therefore a phenomenon of rather infrequent occurrence.

In the best-developed type, that of December, 1928, for example, the current pressure distribution for the month was considerably below normal in the Aleutian and Gulf of Alaska areas and above the normal over the middle part of the North Pacific from approximately the longitude of Midway Island, 177° west longitude, to the western part of the United States. That pressure distribution leads to the inference that cyclonic systems would, as they did, develop and move across the North American continent in relatively high latitudes; the inference is also permitted that by reason of high pressure over western United States, secondary cyclones would develop over the southern plateau and this inference also was realized. The development of cyclonic storms over that region tends to create a flow of cold air southward over the territory west of the Rockies. Finally, as it happened, but we do not know the reason why, there were no strong anticyclones in that month with their associated flow of cold air to the southward which takes place in a normal winter month, but rather nearly all of the anticyclones of the month developed near the Canadian border but within the United States and naturally they did not bring very much reduction in the temperature.

Most of the six cases studied had the common feature of low pressure in the Aleutians and high pressure over western United States as well as over the Pacific between Honolulu and the California coast.

The reverse condition, viz, *warm west, cold east of the Rockies*, will follow when many cyclonic systems pass inland from the Pacific over British Columbia and move thence east or southeast across the Rockies. Cyclones so moving cause a flow of warm oceanic air across the Pacific Coast States and the plateau region. If, now, a number of high-pressure areas (anticyclones) advance south-southeastward from Canada, the point of entry into the United States being east of the Rocky Mountains, and if the movement is continued for several days as in December, 1917, surface temperatures east of the mountains will suffer a pronounced lowering according to the magnitude of the flow of polar air.

6345—30——2

Another moderately frequent temperature distribution in winter months is that in which the line of zero change from the normal runs in a north-south direction, not along the main Rocky Mountains but at some distance eastward. These cases have not been studied in detail but it is believed they differ in no essential from those already discussed.

In addition to the cases where the dividing line between positive and negative departures runs in a north/south direction or at some angle oblique thereto there are cases not very numerous where the dividing line has an east/west direction. In these, as well as in all cases, the use of a time unit other than the calendar month would doubtless yield results that would differ materially from those now available and this would be the case more especially as regards the effect of cold polar air flowing equatorward, since that flow if begun near the close of the month would not have had sufficient time to effect the monthly means of temperature the entire distance between the Canadian border and the Gulf of Mexico. Rather frequently the area of negative departure is confined to the upper Missouri Valley, a favorable point of entry of cold waves from Canada. As might be expected, the distance that frigid temperatures penetrate the United States from the north will depend upon the duration of the polar currents, an extreme case is that of January, 1916, when the temperature departure in Montana was 25° F. below normal and in Florida 9° above.

The distribution *cold north, warm south*, or the contrary, is not frequently experienced. Notable cases occurred in February, 1902, and 1905. In 1902, the monthly mean pressure distribution—the chief control of the temperature—took the form of a southeast/northwest directed ridge of high pressure that stretched from Tennessee to and beyond the Canadian border. This ridge served as a wind divide, places on the east slope having cold northwest winds and places on its west side having southerly to westerly winds. The ridge also served as a barrier over which cyclonic systems from the Pacific could not surmount; these storms therefore moved in a southeasterly direction to the southern plains States and thence east and northeast along the Atlantic coast, a movement which greatly augmented the flow of cold air from higher latitudes and as a consequence the temperature in the Gulf and Southeastern States was 4, 6, 8, and 10 degrees below the normal, while in Wyoming and adjacent States the temperature was about the same amount above the normal thus creating a very abnormal temperature distribution. In February, 1905, the continental ridge of high pressure [1] was exceptionally developed with a single crest that was centered over the lower Missouri Valley and the middle plains States where average pressure was 30.30 inches, close to a quarter inch above the normal. This exceptional development caused the first half of the month to be continuously cold, especially in the south where subnormal temperatures were persistent, the monthly abnormality being as much as 10° below the normal in the Gulf States tapering to about normal temperatures along the Canadian border and thence westward to the Pacific.

Finally there remain to be discussed those months in which the temperature anomaly was uniformly in the same sense in all parts of the country, in other words it was uniformly cold or warm in all parts of the country, although not by the same degree.

In the last 20 years (1909–1928) there have been 36 months during which at least 90 per cent of the total area of the United States had positive temperature departures and in 12 of these months 100 per cent of the total area was uniformly positive. On the other hand but 12 months in the same 20 years had negative departures over at least 90 per cent of the total area and but a single one of the 12, May, 1917, had 100 per cent of area with negative temperature departures.

These facts show unmistakably that the last two decades have been warm. If we go back two more decades, 1889–1908, the count stands 23 warm months as against but 17 cold, or a total in the 40 years, 1889–1928, of 59 warm and 29 cold.

The apparent cause of warm months is to be sought in the pressure distribution in high latitudes, especially Alaska and the North Pacific. One can only say that in certain winters cyclonic storms enter the continent in high latitudes and that for reasons not yet known they are not closely followed by strong anticyclones.

In general, cold months in winter are due to an extraordinary flow of polar air equatorward or to the occurrence of one or more strong anticyclones that affect nearly the whole area between the Rocky Mountains and the Atlantic. The cold weather of the Pacific Coast States is rarely, if ever, felt on the Atlantic seaboard and vice versa and this may account in small measure for the rarity of negative temperature departures in winter over 100 per cent of the area of the United States. The only case of the kind in the last 20 years occurred in the month of May, 1917.

The question is sometimes asked: What is the probability that a month of pronounced abnormality will be followed by one of the same character? The answer is that the chances are about even that it will be followed by another month of the same character, although the magnitude of the depression of temperature may not be nearly so great as in the original month.

[1] By this expression is meant that part of the belt of high pressure that surrounds the globe about North latitude 35° which in winter is strongly developed over the continents and has two peaks of high pressure in the United States and in effect forms a ridge of high pressure between the Atlantic and Pacific.

WEATHER ABNORMALITIES IN THE UNITED STATES (SEVENTH NOTE): TREND OF PRECIPITATION

By ALFRED J. HENRY

[Weather Bureau, Washington, June, 1930]

A study of prolonged drought in southeast Virginia and the adjacent area in northeastern North Carolina has developed the fact that a number of years since 1900 and even before that date were years of generally deficient precipitation in those regions. This suggested an inquiry into the rainfall distribution in the United States since the beginning of the Federal weather service in 1871. At that time the number of stations reporting rainfall was but 48, but by the use of stations in the network reporting to the Smithsonian Institution and by supplementing these by Federal stations established during the early seventies, 1871–76, the total number of stations having at least 50 consecutive years of rainfall records was increased to 123. (See Table 1.)

TABLE 1.—*Precipitation in United States 1871–1895 and 1896–1920 compared*

State and station	Difference	State and station	Difference
	Inches		*Inches*
Alabama:		Mississippi: Vicksburg	−6.6
Mobile	−0.1	Missouri:	
Montgomery	+0.2	Oregon [1]	+2.0
Union Springs [1]	+10.4	Saint Louis	−0.2
Arizona:		Springfield	−1.8
Tucson	−1.4	Nebraska:	
Yuma	+0.3	North Platte	+1.3
California:		Omaha	−5.1
Chico [1]	+2.9	New England S.:	
Folsom [1]	+0.6	Amherst, Mass.[1]	−0.4
Georgetown [1]	−1.0	Boston, Mass.	−7.1
Marysville [1]	+3.0	Canton, Conn.[1]	+1.5
Nevada City [1]	−3.8	Concord, N. H.[1]	−1.4
Sacramento	−3.3	Cornish, Me.[1]	+1.4
San Bernardino [1]	−1.2	Fitchburg, Mass.[1]	+0.6
San Diego	−0.9	Hartford, Conn.[1]	+1.4
San Francisco	−3.0	Lakeport, N. H.[1]	−1.4
Santa Barbara [1]	+1.9	Lake Cochituate, Mass.[1]	−1.9
Summit [1]	+2.6	Lowell, Mass.[1]	−4.1
Colorado: Denver	−0.1	New Bedford, Mass.[1]	−2.3
District of Columbia: Washington	−2.5	New Haven, Conn.	−3.5
Florida:		New London, Conn.	−3.8
Key West	−0.4	Orono, Me.[1]	−3.6
Jacksonville	−9.6	Portland, Me.	−0.6
Georgia:		Providence, R. I.[1]	−5.4
Atlanta	−3.2	Waltham, Mass.[1]	−0.1
Augusta	−4.2	New Jersey:	
Rome [1]	+6.6	Atlantic City	−0.3
Savannah	−6.4	Moorestown [1]	+1.7
Idaho: Boise	−0.4	Newark [1]	+1.9
Illinois:		New Brunswick [1]	−0.2
Chicago	−4.3	Nevada: Winnemucca	−0.2
Cairo	−3.4	New Mexico: Santa Fe	−0.1
Marengo [1]	−1.3	New York:	
Peoria [1]	+0.3	Albany	−6.1
Indiana:		Buffalo	−5.0
Indianapolis	−1.4	Cooperstown [1]	+6.6
Veray [1]	+0.7	New York City	−3.4
Iowa:		Oswego	−0.5
Davenport	−4.2	North Carolina:	
Dubuque	−4.7	Hatteras	−19.6
Independence [1]	−1.6	Manteo	−5.6
Keokuk	−3.9	Weldon [1]	−0.6
Logan [1]	−4.2	Wilmington	−11.1
Muscatine [1]	−2.5	North Dakota: Bismarck	−1.3
Kansas:		Ohio:	
Dodge	−1.3	Cleveland	−3.2
Hays [1]	+1.5	Cincinnati	−3.4
Independence [1]	+0.0	Marietta [1]	+2.1
Lawrence [1]	+0.6	North Lewisburg [1]	+1.0
Manhattan [1]	+2.4	Portsmouth [1]	+1.2
Kentucky: Louisville	−4.4	Wauseon [1]	+1.5
Louisiana:		Oregon:	
New Orleans	−3.8	Astoria [1]	+1.8
Shreveport	−8.0	Portland	−6.6
Maryland: Baltimore	−2.5	Pennsylvania:	
Michigan:		Pittsburgh	−0.8
Alpena	−6.1	Philadelphia	+2.7
Detroit	−0.5	South Carolina:	
Grand Haven	−2.7	Camden	+3.5
Lansing	+0.7	Charleston	−16.5
Marquette	+0.3	Pinopolis [1]	−1.7
Minnesota:		Tennessee:	
Duluth	−4.2	Knoxville	−4.3
Minneapolis	+1.1	Memphis	−7.4
Saint Paul	+1.4	Nashville	−3.9

[1] Cooperative station.

TABLE 1.—*Precipitation in United States 1871–1895 and 1896–1920 compared*—Continued

State and station	Difference	State and station	Difference
	Inches		*Inches*
Texas:		Virginia—Continued.	
Austin	−1.1	Lynchburg	−2.9
Galveston	−4.6	Norfolk	−12.3
Palestine	−9.6	Wisconsin:	
Utah:		La Crosse	+1.0
Corinne [1]	+1.8	Madison [1]	−4.5
Ogden [1]	+2.6	Manitowoc [1]	−4.7
Salt Lake City	+0.3	Milwaukee	−2.3
Virginia:		Wyoming: Cheyenne	+3.3
Cape Henry	−11.1		

[1] Cooperative station.

The basic period of years was 1871–1920 but the use of records for places that began during the years 1871–1876 necessitated of course the extension of the series to years after 1920. Rainfall distribution over large areas for short periods of time is notoriously irregular or spotted. While these irregularities are more or less smoothed out in 50 years in an area so large as continental United States, yet it was found that in certain areas there seems to have been a real diminution of the precipitation. The method followed in the study was to arbitrarily divide the 50-year period into two halves, the first including the years 1871–1895 and the second 1896–1920. The difference between the 25-year averages for the two periods served to show whether precipitation had increased or diminished during the 50-year period.

The differences between the means of the two periods, assuming that the exposure of the rain gages had been practically the same throughout the period should not be widely separated unless there has been a real increase or diminution in the precipitation for the regions occupied by the respective stations.

Probably less than 5 per cent of the records used were derived from gages that presumably had the same exposure from beginning to end. The labor of determining the successive exposures of rain gages during the last fifty-odd years and of analyzing the records of rainfall for each exposure is prohibitive. Owing to causes over which the Weather Bureau has no control it has been necessary during the last half century to make frequent changes in office-quarters occupied by the field stations; almost invariably the change has been from a low to a higher building and with each increase in elevation the probability of a faulty gage exposure has increased.

Stations west of the 100th meridian are too few in number to afford any reliable indication as to changes, if any that have taken place in that region. The group of stations in middle California give contrary results possibly due to local differences that the run of years has not completely eliminated. An area extending from southeast Wyoming through Nebraska and part of Kansas to northwest Missouri appears to have had slightly greater rainfall in the second than in the first half of the period and this is also true of a part of northeast Utah in the vicinity of Great Salt Lake, also of southeast Minnesota; Ohio, also has a record of slightly greater rainfall the second than in the first half of the 50-year period.

Considering now the areas where the precipitation of the second half of the period was less than that of the first,

there are two outstanding areas where the difference in rainfall is pronounced, viz, from northeast Texas through Louisiana and Mississippi to western Tennessee and the lower Ohio Valley and again along the Atlantic Coast from the Virginia Capes to Jacksonville, Fla., not to mention the upper Lake region from Alpena to Milwaukee.

FIGURE 1.—Average annual deficiency of precipitation in southeast Virginia and northeast North Carolina for the 11 years 1909–1911

Detailed examination of the rainfall records maintained at Cape Henry and Norfolk, Va., and Hatteras, N. C., has shown conclusively, that the rainfall catch at those stations for a part of the second half has been deficient due in the main to gage exposure. At the same time it was also established that precipitation, rather generally east of the Appalachians in Virginia and the Carolinas has been less than normal for a number of years subsequent to 1900.

A special study has been made of the region shown in Figure 1 for the years 1909 to 1919 both inclusive. I give in Table 2 the annual departure of the rainfall from the normal for 22 stations in the area in question; two of the years, viz, 1910 and 1917, might easily be classed as years of normal or slightly above normal rainfall and curiously both of these years were dry years in the United States as a whole.

A correction has been determined and applied to the record of rainfall for Cape Henry and steps have been taken to determine a proper correction for the Norfolk and Hatteras records. The announcement of these corrections will have to be deferred until such time as comparative rain-gage readings extending over a year or more are available.

Heavy rains in the region shown in Figure 1 are due almost wholly to the northeastern movement of cyclonic storms from the Gulf of Mexico or thereabouts to New England, including those tropical cyclones which move northward along the coast or a short distance therefrom. An important consideration, at all times, is the rapidity of movement of the storms in question since whenever the movement is retarded, for example, by high pressure over New England, the additional time that the cyclone center rests over any part of the area gives that area more continuous and naturally a greater quantity of rainfall. It will happen therefore that the seemingly fortuitous pressure distribution may be the cause of greater than normal rainfall.

Aside from a deficient catch due to improper exposure of the rain gage there are times when the natural rainfall over the region in question is considerably less that the normal. The weather maps on such an occasion show that the Appalachians evidently cast a rain shadow over the piedmont region to the eastward; this rain shadow is apparent when cyclonic storms moving to the eastward along the Canadian border pass down the St. Lawrence valley without giving appreciable rain south of the Pennsylvania line. There is another cause that operates to diminish the rainfall of the Carolinas and Virginia, viz, the westward extension of high pressure from the Atlantic, as when the Bermuda anticyclone is well developed to the westward and the high pressure, 30.10 to 30.20 inches, overlies the Carolinas and Georgia. At such time the rainfall is light and irregularly distributed.

TABLE 2.—*Annual precipitation departures 1909–19*

[Inches and tenths]

Stations	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	Average	Normal annual
Lynchburg, Va.	−10.5	−1.4	−2.6	−0.8	−5.5	−10.0	−7.8	−2.1	−9.3	−10.2	−3.1	−5.8	41.7
Callaville, Va.	+0.1	+7.6	−1.3	−8.4	−5.7	−3.6	−6.5	−5.0	+5.2	+5.4	+3.0	−0.8	45.5
Richmond, Va.	−7.6	+1.3	−4.8	−6.2	−4.1	−9.0	−5.4	−4.6	+1.5	−0.5	−1.7	−3.7	41.8
Hopewell, Va.	−3.5	+7.4	−7.4	−8.2	−6.7	−4.6			−2.8	+6.5	−0.5	−2.7	44.8
Williamsburg, Va.	−2.0	+3.0	−3.1	−5.6	−3.2	−17.3	−6.5	−2.5	+4.3	+6.0	−4.0	−2.8	46.4
Runnymede, Va.	−2.9	+1.3	−5.3	−8.0	+1.5	−5.6	−7.0	−10.0	+6.5	+6.5	−6.9	−2.7	49.2
Newport News, Va.	−1.8	+4.7	−2.9	−10.7	−0.2	−7.0	−0.9	−6.3	+3.7	+3.6	−4.4	−2.0	45.3
Diamond Spgs., Va.	−5.5	−1.3	−2.1	−4.4	+4.2	−5.0	−2.5	−1.1	+8.1	−2.9	−2.8	−1.4	42.6
Norfolk, Va.	−12.6	−6.1	−7.5	−12.0	−3.0	−11.4	−10.3	−12.6	−0.8	−15.5	−13.0	−9.5	46.4
Cape Henry, Va.	−10.4	−6.7	−11.6	−12.3	−1.3	−12.3	−19.2	−12.3	+0.1	−10.8	−12.4	−9.9	46.9
Henderson, N. C.	−7.8	+1.9	+5.1	−1.1	+0.3	−1.3	−6.1	−5.6	+4.3	+0.8	+2.9	−0.9	44.8
Weldon, N. C.	−10.5	+3.7	−7.3	−8.3	−7.0	−7.3	−9.3	−4.8	+6.0	−1.4	+4.0	−3.8	46.1
Louisburg, N. C.	−5.3	+4.7	−1.4	−8.0	+1.9	−1.9	−10.6	−5.2	+5.1	−3.4	+1.3	−2.1	45.7
Raleigh, N. C.	−6.8	+0.5	−8.6	−7.1	+0.5	−2.5	−7.1	−5.7	+2.0	−4.9	−5.9	−4.3	46.6
Tarboro, N. C.	−3.2	−0.6	−8.5	−4.5	+0.0	−5.9	−4.1	−4.3	−4.0	−8.8	−2.7	−3.5	49.6
Goldsboro, N. C.	−9.3	+3.1	−15.8	−5.1	+2.9	−1.7	−2.1	−8.0	+6.8	−5.8	−1.7	−3.3	50.6
Edenton, N. C.	−3.5	+5.3	−9.1	−8.3	+2.4	−0.8	−14.9	−10.8	+11.1	+4.9	−3.2	−2.4	50.4
Scotland Neck, N. C.	−1.0	−0.3	−2.7	−2.1	−0.3	−4.0	−3.7	−0.4	+2.0	−9.1	−2.1	−2.2	42.1
Manteo, N. C.	−2.6	+4.7	−16.2	−5.5	−8.5	−16.2	−8.2	−11.6	−3.9	−11.2	−5.2	−7.2	52.5
Hatteras, N. C.	−19.3	−19.6	−25.1	−5.0	−11.3	−17.1	−16.1	−16.6	−9.8	−17.7	−21.5	−16.3	54.7
Beaufort, N. C.	−6.7	−6.7	−15.7	+7.7	+1.8	−3.0	−9.8	−5.7	+1.5	−11.4	−9.1	−5.2	48.5
Newbern, N. C.	−5.0	+12.6	−13.8	−0.3	+4.6	+3.6	−10.3	−6.8	+4.3	±0.0	−10.0	−2.0	56.5

RECORD RAINFALL FOR MIAMI, FLORIDA

By GEORGE V. FISH

[Weather Bureau Office, Miami, Fla.]

On June 19, 1930, the following note was made in the local station records:

During the 24-day period beginning with May 27 and ending with this date, 33.16 inches of rainfall were recorded. This amount equals 60 per cent of the normal annual rainfall, and it greatly exceeds any amount previously recorded at this station in a period of 24 days. All low lands were flooded by the heavy rains, and a large acreage of corn and potatoes was destroyed.

During this period of excessive rainfall several records were broken for the Miami station. From the information available, it is believed that the five-day period from May 29 to June 2, inclusive, was one in which the total duration of excessive precipitation, compiled according to rule, eclipsed all previous records for southern Florida, and probably for continental United States for a similar period, by a comfortable margin.

The first station record to fall was the greatest amount in 24 hours for the month of May. The previous record had been 5.26 inches, established on May 30–31, 1919. The new record is 9.36 inches, on May 31–June 1, 1930. Of this amount, over one-half fell in the last 11 hours of May 31.

The next record is remarkable for the duration of time during which precipitation occurred at an excessive rate. According to the rule used for computing excessive precipitation in the Weather Bureau, a duration of 43 hours and 56 minutes at the rate of 2.50 inches in twenty-four hours is indicated. During this period 16.49 inches of rainfall were recorded. The period began at 12-47 p. m. on May 31, and continued until 1:20 p. m. on June 2.

The pressure conditions attending this record fall and duration of excessive precipitation are as follows: For several days preceeding this period, the pressure over the tropical regions to the south had been relatively low. The 8 a. m. weather map of May 29, 1930, showed indications of a disturbance over the lower Rio Grande Valley. During the day, this slight disturbance increased somewhat in intensity and moved eastward over the Gulf of Mexico. In the meantime a high pressure area of wide extent, attended by low temperatures, was quite rapidly overspreading the central plains states and the Ohio valley. The following morning the LOW appeared as a well defined disturbance over the Florida peninsula. The HIGH had continued a southeastward movement and had, on the morning of the 30th, extended its influence to the Atlantic coast.

During the day of the 30th the Florida disturbance moved quite rapidly northeastward, attended by heavy rains locally over the Florida Peninsula. The HIGH then settled over the Carolinas where it remained practically stationary for the next five days. Table 1 shows the hourly rainfall for the 24 days.

DISCUSSION

The above record of almost continuous rainfall for a period of close to 44 hours has several noteworthy features; for convenience of discussion the 24-day period will be broken up into several shorter periods as follows:

(1) The rains of May 29–30 (thunderstorm).
(2) The rains of May 31–June 2 (??)
(3) The rains of June 8–19 (thunderstorm).

The rains of Group 1 were due essentially to the movement of a strong anticyclone, 30.40 inches, from Manitoba on May 29 to the Carolina coast on June 1, especially to the influence exerted by this movement upon the development and movement of a secondary cyclone over the Gulf of Mexico on May 30 at a time when pressure was low and the gradients over that body of water were weak. This secondary on the morning of May 30 merged with a trough of low pressure that stretched from Florida to Hatteras, N. C. The trough disappeared on the afternoon of that date but not before yielding several thunderstorms and fairly heavy rains on May 29–30.

The rains of Group 2 seem to belong to a different type although they began with a thunderstorm in the afternoon of May 31. At that time the anticyclone above mentioned had begun to control the oceanic winds east of Florida and the winds at Miami backed from south through west and north to northeast and east. Almost coincidently with this change in wind direction light rain set in only to be immediately followed by a thunderstorm and heavy rain. (See Table 1.)

At the first burst of the oceanic winds over Florida general though not heavy rain set in; these rains north of Miami soon ceased and while it rained continuously at Miami for two days the skies over northern Florida were clear until the next day when clouds again formed.

The oceanic winds were not strong at any time, averaging about 14 miles per hour.

Table 1 shows that maximum hourly rainfalls occurred as follows:

(1) Hour ending at 5 p. m. May 31.
(2) Hour ending at 10 a. m. June 1.
(3) Hour ending at 3 a. m. June 2.

with a secondary maximum about noon of the same date.

It is assumed in explanation of these rains that the oceanic air brought onto the southeast Florida coast was not only cooler than the air in situ but of greater moisture content; that a condition of vertical instability was created as is evidenced by the thunderstorm that broke soon after the beginning of the rain on May 31. Examination of the direction of the rain clouds that passed over Miami reveals the fact that they varied from southeast to northeast from which it is assumed that the maximum hourly falls may have been due to a slight change in the direction of the incoming rain clouds, thus bringing fresh masses of moist air over Miami.

The 24-hour record rainfall in the United States held by the rains of September 9–10, 1921, at Taylor, Tex., was not broken. The total for that storm was 23.11 inches in 23 hours and 58 minutes.—*A. J. H.*

TABLE 1.—*Hourly precipitation, inches and hundredths, at Miami, Fla., May 27 to June 19, 1930, inclusive*

[Traces omitted]

Date	A. M.												P. M.												Total
	1	2	3	4	5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	9	10	11	Midnight	
May 27											0.33	0.86	0.30		0.02										1.51
May 29																	0.88	0.72					0.03	0.02	1.65
May 30		0.03				0.02		0.03			.01			0.23	.04	0.01									.37
May 31				.02	.02								.01	.14	.94	1.22	1.51	.72	.02	.03	.01	.08	.02	.08	4.82
June 1	.03			.03	.21	.17	.08	.03	.05	1.87	1.20	.30	.32	.33	.12	.02	.33	.20	1.02	.37	.24	.13	.09	.01	7.17
June 2	.64	.42	.72	.10	.16	.14	.12	.16	.09	.12	.44	.71	.56	.22	.04		.03		.02	.42	.15	.01			5.27
June 5				.02																					.02
June 7				.03																					.03
June 8			.07	.17	.01										.01			.19	.10	.87	.53	.04			2.89
June 9										.02	.05	.95				.03	.01								1.06
June 10				.03																	.02				.05
June 11																					.01				.01
June 12																					.02	.78	1.58	.52	2.90
June 13	.23	.04										.01	.01	.02	.06	.01	.03	.07	.05	.07	.02	.02	.01	.05	.70
June 14		.01		.05	.01																				.07
June 15							.02			.07	.09	.01		.54		.81	.08			.01					1.63
June 17		.06																		.09	.07	.43	.80		1.45
June 18			.07														.03	.02							.12
June 19			1.44																						1.44
Sums	.90	.56	2.30	.45	.41	.33	.22	.22	.14	2.08	2.12	2.84	1.20	1.48	1.23	2.10	2.90	1.92	1.21	1.86	1.07	2.39	2.53	.70	33.16

NOTES, ABSTRACTS, AND REVIEWS

An upper air temperature indicator for use with pilot balloon, by G. Chatterjee. Reprinted from "Gerlands Beiträge zu Geophysik," vol. 24 (1929), pp. 343–352, Vienna.—Author's summary: The paper describes a simple instrument intended to be used with ordinary pilot balloons for determining temperature levels in the atmosphere. The instrument is essentially a 2-pronged fork in which both prongs are bimetallic strips that open outwards as the temperature falls. At a set temperature, the opening of the prongs releases a chemical "trigger" by allowing a very small capillary U-tube containing strong sulphuric acid to drop into a finely powdered mixture of sugar and potassium chlorate. This burns the string holding the instrument to the balloon. The release of the instrument from the balloon at the predetermined temperature is observed in the field of view of a theodolite and the height of the balloon at the moment is determined by the tail method. The weight of the instrument is about 40 grams.—*C. F. B.*

The electric field of overhead thunderclouds,[1] *by S. K. Banerji.*—Changes in the electric field produced by eighteen thunderclouds during their passage over the Colaba Observatory in 1929 suggest that the majority were of the "unitary type" and had their front part negatively charged, the central part positively charged, and the rear negatively charged. A few were of the "double type" and produced changes in the field as if two thunderclouds of unitary type had passed over in succession. In those thunderclouds which caused heavy rainfall, fluctuations in the central positive field occurred by loss of charge by rainfall or by increased concentration of positive charge by increased vertical current, in agreement with the breaking-drop theory. The monsoon clouds produced an electric field which was preeminently negative during periods of rainfall.

A new rainfall chart of the earth.[2]—The author has collected, mainly from World Weather Records and the volumes of Reseau Mondial 1911–1920, more than 500 records of precipitation for the 10 years, 1911–1920. The majority of the records cover the full 10 years, those which have less than 9 years have been adjusted to the full period and used in the compilation of the chart. The latter is on a scale of 1:100,000,000, and shows the distribution of rain over land and sea according to the following scale of intervals: 0–25, 25–50, 50–100, 100–150, 150–200, 200–300, 300 and more centimeters.—*A. J. H.*

The rôle of the oceans in the weather of western Europe,[3] *by C. E. P. Brooks, D. Sc.*—Doctor Brooks is the author of two Geophysical Memoirs, Nos. 34, 1926, and 41, 1928, bearing upon the influence of oceanic currents and Arctic ice, respectively, upon the weather of Europe. In the present paper he draws upon the information presented in those memoirs to elaborate and present in much detail his ideas as to the bearing of oceanic conditions upon the weather of adjacent land areas.

In his opening paragraph he likens the North Atlantic to a great bath having one hot and two cold taps; the hot tap is, of course, the Gulf Stream and the two cold ones the Labrador and East Greenland currents. These taps are always running sometimes at full capacity and at others much diminished in volume.

Some curious interrelationships are described, one in particular will be mentioned. This relates to the pressure variations at Iceland and the west coast of Ireland following variations of the ice index of 5 units above normal. The ice index is merely a convenient unit to express the distribution of ice in Kara Sea, Greenland Sea and Barents Sea. It was computed for each year from 1895 to 1928 during which period its largest value was 145 in 1917, a year of rather low winter temperature in both Europe and North America.

The relations between variations of the ice index and subsequent pressure changes in Iceland and Valencia are striking. The author remarks in this connection:

> These curious relationships present some difficult problems for the meteorologist to solve, especially the reason why a large amount of ice in the Arctic should cause high pressure and fine weather at one season, low pressure and stormy weather at another season. We may summarize the position as follows:
>
> (1) When there is much ice in the Arctic, pressure in spring and summer tends to be above normal in the northwest (Greenland, Iceland, and the Faroes) and below normal in the southwest (the Azores).

[1] Reprinted from Nature, May 10, 1930.
[2] Erwin Ekhardt in Petermanns Mitteilungen Heft 3/4.

Condensed from Quart. Jour. Roy. Met. Soc. LVI: April, 1930.

(2) When there is much ice in the Arctic in spring and summer, pressure in the following late autumn and winter (November to January) tends to be below normal over the British Isles and northern France.

(3) Similar effects tend to occur annually at northern stations for about four years following abnormal ice years.

Space does not permit us to go into details as to how the ice and cold water react on the atmosphere to produce the results outlined above.—*A. J. H.*

RAINFALL–ALTITUDE

Notes on rainfall and evaporation, by Dr. G. E. P. Smith, irrigation engineer, University of Arizona, Tucson, Ariz.—In 1910 I published a chart showing by graphs the approximate relation of rainfall to altitude in this region. The chart has curves for two contiguous areas, one for Pinal and Pima Counties, one for Cochise and Graham Counties. To assist in weighting the records, the length of each record is represented by the size of the plotted point. The Pinal-Pima curve shows equal rainfall for elevations about 1,000 to 1,500 feet below the Cochise-Graham curve.

These curves are criticised in Mead's textbook on Hydrology, as follows: "The author (Mead) has been unable to ascertain any adequate reason for the differentiation between these counties, or for the belief that there is any increase in annual rainfall above the 4,000-foot contour." The answer to both of these points is topographic relations. The rainfall at any locality is dependent upon the relation of its altitude and exposure to the surrounding country. In Cochise and Graham Counties, the valley floors are higher and in general the mountains are higher. If the entire State and northern Sonora were raised bodily 1,000 feet the rainfall at each point might not be changed. The influence of local topography also will prevent the plotted points from falling on a smooth curve. It is probable that there should be a reverse flexure at approximately 7,000 feet the altitude of the top of the steepest part of the mountain sides. I think that a query more difficult to answer would be, "Why should the rainfall in Pinal County be equal to that in Cochise County?"

TRANSPIRATION FROM FORESTS

At Redington, a neglected part of this State, there are two mature forests, one of cottonwood and one of mesquite, situated about 4 miles apart. Some years ago I studied the transpiration of these forests as measured by the effect on the ground-water table. A consistent, variable, diurnal curve was recorded throughout the year except for the winter when the trees were defoliated and during that period the rise and fall of the water table recorded accurately the approach and departure of storms.

By comparing the water-table curves with meteorologic conditions, it was seen that transpiration was influenced by temperature, humidity, cloudiness, and other climatic factors.

The transpiration curve derived from the water-level records does not "follow" the temperature or humidity curves, but leads them both.

Cloudiness must be a factor of importance. On many dates it is apparent that during the cloudy part of the day the water loss is greatly reduced. However, on June 3, the date of the great Pueblo flood, I was at Redington and observed that the sun was not visible during the day save for a few minutes about midafternoon, but the transpiration was almost normal, at least within 10 per cent of the water loss of the preceding day, which was clear. The day was peculiar, in that the haze was very high and there were no drifting clouds of the usual sort. The temperature on that day was below normal. The inference is that temperature and humidity, rather than sunlight, are the direct factors, or at least that the light itself is of less importance than is usually stated.

The beginning of transpiration effects in early spring occurs at the time of budding. The budding itself does not seem to entail much water loss and, quite peculiarly, during the early period of leafing the loss appears to be continuous throughout the 24 hours. Possibly the latter phenomenon is due to replenishment of the sap after the dormant period. In the cottonwood forest the descent of the water table began on March 1, though budding started several days earlier. The nocturnal recharge began to show on March 18. In the mesquite forest the descent of the water table and the budding began April 15, and recharge showed on the 25th.

RECAPTURE OF WATER SUPPLY

The total stream flow of the Colorado River system available for irrigation use is approximately 21,000,000 acre-feet annually. Of this total, approximately 13,000,000 acre-feet is discharged into the Gulf of California. Time will come, perhaps in 40 years, when nearly all of that 13,000,000 acre-feet will be applied in irrigation use and will be evaporated from the basin, mostly from the portion of the basin south of the Grand Canyon. The prevailing winds are from southwest to northeast and during periods most favorable to summer rainfall the winds are from southeast or east. In either event much of the vapor will be carried toward high mountain ranges within the river basin and it is conceivable that 15, even 25 per cent of the quantity may be recovered by orographic rainfall. This may add to the total available supply 2,000,000 or 3,000,000 acre-feet of water, sufficient to irrigate an area greater than the total under irrigation in Arizona at the present time.

RAINFALL CYCLES

A graph of the Tucson rainfall shows a 34-year period, and any subcycle within this of minor importance. California hydrologists discuss a 35-year cycle, though Sonderegger points to a 22-year cycle in southern California. Doctor Douglass has quite a number of periods with which he toys on state occasions. Too many cyclic periods have been proposed. It would appear that causes of variation are multifarious, and the problem, though worthy of research, is not to be easily solved. I am attracted also by the problem of balance between different storm paths. The Nile maximum stream flow occurs at periods of low rainfall in Europe. Rainfall in Idaho and Arizona may be of opposite phase, and I have noticed that during droughts Arizona stockmen have shipped cattle to Idaho and Montana has shipped to Texas.

Although the Tucson rainfall chart makes a pretty picture, I have not much faith that it will go on repeating itself, or that meteorologists will ever be able to make long-range wet-or-dry forecasts with more than 50 per cent accuracy.

EROSIONAL TERRACES

My office has mapped the physiographic areas surrounding Tucson. There are four well-defined terraces,

each representing a distinct uplift or change in climate, and a distinct epoch or time. Logs of wells prove that, in at least two cases, the erosion was carried beyond present levels and was followed by aggradation to the terrace levels as we find them. Whether there was any periodicity in the successive erosions and refillings is beyond human ken.

SUMMER RAINFALL

The summer rainfall of Arizona is unique, and offers a fascinating field for study. The typical rains are local in character, though in exceptional cases there is general rainfall over much of the State. The typical valley rain is a thunderstorm, originating at the base of a mountain or more often at the base of a mountain pass, and proceeding rather leisurely along the valley with width of from a half mile to several miles. It may continue for 40 miles or more before it dies out or moves out of observation through a pass. The best immediate indication is that the massive cumulus clouds that build up over the mountains at noon move out in a northwesterly or westerly direction, regardless of the direction of surface breeze. If the clouds at noon move east or northeast, there is little likelihood of rain.

Most of these storms occur between 3 p. m. and midnight, and by morning the sky is clear again.

As pointed out by Weather Bureau forecasters, favorable conditions for summer rains are indicated by the presence of a wedge or area of high pressure from the northwestern states reaching down as far as Colorado or even into New Mexico. The circulation of such areas combined with the summer "low" of the lower Colorado Valley must induce a strong movement of air in a general northwesterly direction. A possible hypothesis is that the ascent of the heated air of the valleys is accompanied by the descent of moisture-laden air from the tropics that has been cooled over the mountains of Mexico.

South African rainfall, effectively presented by new graphical method.[4]—The wide variation in rainfall from place to place in South Africa, and the fact that nearly 73 per cent of the Union has rainfall of less than 25 inches lends value to this report of station data with maps. Average monthly and yearly rainfall, in inches, for about 7,500 stations is given, the data being presented as from October around the year to September, because the seasons of precipitation are thus more clearly shown than in the usual January to December arrangement. An index directs the reader to sectional maps (squares of 2° longitude by 3° of latitude, scale of 20 miles to the inch), showing location of all reporting stations and detailed distribution of rainfall by isohyets for each 5 inches. The material is summarized in three large colored maps in a pocket.

The general map of average annual rainfall for the region south of latitude 22° S. (scale 40 miles to the inch) is notable because of the detail and very small areas of differing rainfalls noted thereon. The color scheme has been adopted to distinguish particularly that portion of South Africa having less than 25 inches annually from the more humid sections. Ascending scales in intensity of coloring have been used from white through yellow to dark orange for the 0 to 25 inches regions and from green through red and blue to black for 25 to 100 or more inches of rainfall. Due to paucity of records for certain areas, the author has used his personal knowledge of the topography and vegetation of the country to assist in guiding the isohyets.

Being a plateau with rugged borders exposed to the southeast trades and the prevailing westerlies off the ocean the rainfall is as high as 100 or more inches on the highest peaks, while there are scattered areas of 25 to 50 inches, and large regions below the 25-inch isohyet. The sharp rise of land close to the coast, severely limits the arable land to a coastal strip. Compared with the map of J. B. Kincer, on Shantz's, and Marbut's Land Classification Map of Africa,[5] the Lewis map, shows in far greater detail its close relationship of rainfall to topographic variations.

The variability in rainfall suggested the use of a novel rainfall clock map. Each space of the clock represents a month, the lower six months being the winter half-year and the upper the summer. Red and blue represent dry and wet months respectively, a dry month being one in which the average rainfall is under 0.7 of a twelfth of the annual total, while a wet month is taken as one having over a sixth of the annual mean. The average annual is the radius of a dotted red circle that determines the general size of the clock. The rainfall clock map is especially effective in emphasizing the differences in annual rainfall and seasonal distribution.

To differentiate further the differences in rainfall over South Africa three main zones are delineated; a west coast zone of winter rainfall, the south coast zone of even rainfall and a northeast summer rainfall zone. Subzones are also marked based on the concentration of rainfall within the large zones within designated portions of the rainy season.

As a large number of the rivers of the Union derive their waters from Basutoland and Swaziland, tables of the area with rainfalls between certain limits are presented, but should be regarded as very rough approximations.

The third map, of total yearly rainfall for selected years, is of the bar graph variety, each bar being divided into summer and winter halves (outline vs. solid). It illustrates the marked variability yet the difficulty of tracing periodicity in rainfall. The terminology chosen by the author is unusual in that he discusses the distribution of annual rainfall in terms commonly used for describing natural configuration from a contoured map, for example "spur," "kopje," "depression," "valley," "neck," "slope," "descent."

The section maps, showing station locations and isohyets of small areas, coupled with the voluminous index of rainfall stations, make this publication an effective tool for local use.—*Donald S. Gates.*

Tornado in New Mexico, by C. E. Linney.—A rather well defined tornadic storm occurred shortly after 5 p. m. May 31, 1930 at Wagon Mound, a small town on the Atchison Topeka & Santa Fe Railroad in eastern Mora County, N. Mex. On the morning of that date a cyclonic system of wind circulation in which tornadoes usually develop was centered about 300 miles to the west of Wagon Mound. Considering the nature of the storm winds and the destruction of between 40 and 50 homes and about 8 other structures devoted to business purposes and the meteorological conditions under which it occurred (in the southeastern quadrant of a cyclonic storm) there appears to be but little doubt as to the tornadic character of the winds. The storm appears to have developed about 3 miles to the south of the town

[4] Rainfall Normals, Up to the End of 1925, with an Introduction and Brief Summary of the Rainfall of the Union of South Africa, by A. D. Lewis, director of irrigation. 109 pp., 35 maps. Published by Union of South Africa, Department of Irrigation, Meteorological Office, Cape Town, 1927. In Dutch and English. 8 by 12½.

[5] H. L. Shantz and C. F. Marbut, Vegetation and soils of Africa, An. Geogr. Soc., Research Ser. No. 13, New York, 1923.

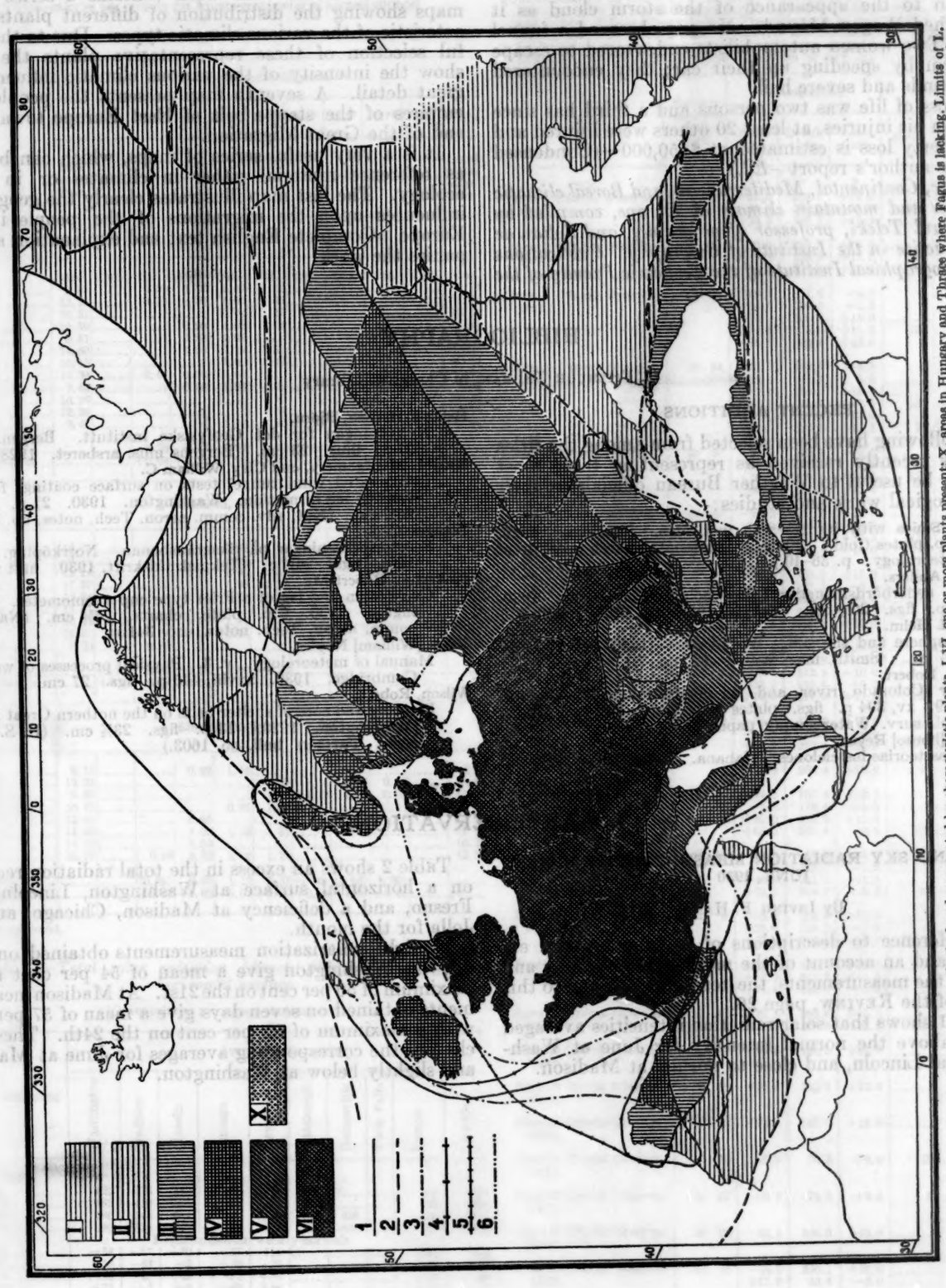


FIGURE 1.—Oceanic climatic influences as synthetised and represented by characteristic plants. I–VI, one or more plants present; X, areas in Hungary and Thrace where Fagus is lacking. Limits of I.. Calluna vulgaris, heather; 2, anemone nemorosa; wood anemone; 3, Tilia cordata, small-leaved linden; 4, Quercus robur., English oak; 5, Fagus silvatica, European beech; 6, carpinus betulus, European hornbeam.

and to have swept rapidly through it in not more than two minutes. No one appears to have paid particular attention to the appearance of the storm cloud as it approached Wagon Mound. No one observed a funnel cloud. Two women automobilists endeavored to escape the storm by speeding up their car; they encountered strong winds and severe hail.

The loss of life was two persons and a third has since died from his injuries, at least 20 others were injured and the property loss is estimated at $150,000—(Condensed from the author's report—*Ed.*)

Oceanic, Continental, Mediterranean, and Boreal climatic influences and mountain climate in Europe, compiled by Count Paul Teleki, professor of geography, and Zoltán de Nagy practice in the Institute of Geography. Publications of the Geographical Institute of the Economic Faculty of the University, Budapest, No. 1, 1930. Reviewed by Sigismond R. Diettrich.—The work contains a series of six maps showing the distribution of different plants characteristic of the various climatic types. Due to the careful selection of these representative plants the maps show the intensity of the various climatic influences in great detail. A seventh map presents the peoples and empires of the steppe belt of East Europe toward the end of the Great Migration.

It is a very useful series of maps, which can be used as reference material either in climates or in plant ecology. The last map illustrates clearly the geographic influences upon the migrations of the people in east Europe. Complete English text and explanation accompanies the work.

BIBLIOGRAPHY

C. FITZHUGH TALMAN, in Charge of Library

RECENT ADDITIONS

The following have been selected from among the titles of books recently received as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies:

Academia Sinica with its research institutes. Shanghai. 1929. 69 p. plates (fold.) 20 cm. [National research institute of meteorology. p. 36–40.]

Ångström, Anders.
Stora nederbördsmängder i Stockholm. Norrköping. 1930. 15 p. figs. 20½ cm. (Teknisk tidskrift. 1929. Häft 52.)

Clayton, H. Helm.
Atmosphere and the sun. Washington. 1930. 49 p. figs. 24½ cm. (Smith. misc. coll. v. 82, no. 7.)

Follansbee, Robert.
Upper Colorado river and its utilization. Washington. 1929. xv, 394 p. figs. plates (part fold.) 23½ cm. (U. S. Geol. surv. Water-supply paper 617.)

Gavilan, A[lfonso] Reyes.
Nuevas teorias los ciclones. Habana. 1930. 32 p. 19½ cm.

Helland-Hansen, Bjørn.
Nybygningen for det Geofysiske institutt. Bergen. n. d. 21 p. illus. 23 cm. (Bergens mus. arsberet. 1928–1929.)

Knight, Montgomery, *and* Clay, William C.
Refrigerated wind tunnel tests on surface coatings for preventing ice formation. Washington. 1930. 21 p. plates. 26½ cm. (Nat. adv. comm. aeron. Tech. notes. no. 339.)

Östman, C. J.
Snöstormsvarningar på riksgränsbanan. Norrköping. 1930. 15 p. figs. 20½ c. (Teknisk tidskrift, 1930. häft 1.)

Pinkerton, Robert M.
Calibration and lag of a Friez type cup anemometer. Washington. 1930. 8 p. plate. charts. 26½ cm. (Nat. adv. comm. aeron, Tech. notes. no. 341.)

Shaw, [William] Napier.
Manual of meteorology. v. 3. Physical processes of weather. Cambridge. 1930. xxviii, 445 p. figs. 27 cm.

Wilson, Robert.
Planting and care of shelter belts on the nothern Great Plains. [Washington. 1929.] 13 p. figs. 23½ cm. (U. S. Dept. agric. Farmers' bull. no. 1603.)

SOLAR OBSERVATIONS

SOLAR AND SKY RADIATION MEASUREMENTS DURING JUNE, 1930

By IRVING F. HAND

For reference to descriptions of instruments and exposures, and an account of the method of obtaining and reducing the measurements, the reader is referred to this volume of the REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged slightly above the normal intensity for June at Washington and Lincoln, and close to normal at Madison.

Table 2 shows an excess in the total radiation received on a horizontal surface at Washington, Lincoln, and Fresno, and a deficiency at Madison, Chicago, and La Jolla for the month.

Skylight polarization measurements obtained on four days at Washington give a mean of 54 per cent and a maximum of 56 per cent on the 21st. At Madison measurements obtained on seven days give a mean of 57 per cent with a maximum of 69 per cent on the 24th. These are close to the corresponding averages for June at Madison and slightly below at Washington.

TABLE 1.—*Solar radiation intensities during June, 1930*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.

Date	Sun's zenith distance										
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	Mm.	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Cal.*	*Mm.*
June 2	8.81	.....	0.69	0.87	1.04	1.30	.....	.....	.....	.....	6.76
June 3	12.24	.....	0.77	0.96	1.08	1.30	.....	.....	.....	.....	8.81
June 4	10.21	.....	.....	.....	0.94	1.23	0.92	.....	.....	.....	14.10
June 5	10.59	.....	.....	0.80	1.03	1.23	.....	.....	.....	.....	11.81
June 11	8.81	.....	.....	0.83	1.04	.....	.....	.....	.....	.....	8.18
June 16	14.60	.....	.....	0.94	1.12	1.39	.....	.....	.....	.....	13.61
June 19	15.11	.....	.....	.....	0.90	1.19	.....	.....	.....	.....	10.59
June 21	12.24	.....	0.64	0.79	0.98	.....	.....	.....	.....	.....	9.14
June 23	9.83	.....	.....	0.95	1.04	1.29	.....	.....	.....	.....	9.83
June 26	16.20	.....	.....	.....	.....	1.19	.....	.....	.....	.....	19.23
June 27	12.24	.....	.....	.....	.....	1.34	.....	.....	.....	.....	9.14
June 28	9.47	.....	.....	.....	1.02	1.22	.....	.....	.....	.....	10.21
Means	.....	.....	0.70	0.88	1.02	1.27	(0.92)	.....	.....	.....	.....
Departures	.....	.....	+0.04	+0.12	+0.10	+0.05	+0.01	.....	.....	.....	.....

Madison, Wis.

June 4	12.24	.....	.....	.....	0.92	1.16	.....	.....	.....	.....	10.97
June 9	9.14	.....	.....	.....	1.09	1.26	.....	.....	.....	.....	10.97
June 20	12.24	.....	.....	0.89	1.06	1.33	.....	.....	.....	.....	12.68
June 23	17.37	.....	.....	.....	1.03	1.23	.....	.....	.....	.....	19.89
June 24	12.24	.....	.....	1.05	1.20	1.35	.....	.....	.....	.....	11.38
June 25	13.61	.....	.....	.....	.....	1.34	.....	.....	.....	.....	15.11
June 26	10.21	0.76	0.85	0.99	1.17	1.38	.....	.....	.....	.....	10.59
June 27	11.81	0.73	0.84	0.98	1.14	1.34	.....	.....	.....	.....	12.24
June 28	7.29	.....	0.81	.....	.....	.....	.....	.....	.....	.....	9.47
Means	.....	(0.74)	0.83	0.98	1.09	1.30	.....	.....	.....	.....	.....
Departures	.....	+0.03	−0.04	+0.02	−0.01	−0.02	.....	.....	.....	.....	.....

Lincoln, Nebr.

Jun 6	8.18	.....	.....	0.97	1.18	.....	.....	.....	.....	.....	8.81
June 15	12.24	.....	.....	.....	.....	1.30	1.14	0.96	0.79	.....	8.48
June 17	9.83	.....	.....	.....	.....	1.46	1.18	0.99	0.82	.....	10.21
June 21	16.79	.....	.....	.....	0.97	1.41	.....	.....	.....	.....	20.57
June 24	12.68	.....	.....	0.93	.....	.....	.....	.....	.....	.....	15.11
June 26	11.38	.....	.....	1.02	1.18	1.37	.....	.....	.....	.....	11.38
June 28	14.10	.....	.....	0.89	.....	.....	.....	.....	.....	.....	16.20
June 30	10.97	.....	0.86	0.92	1.16	1.29	.....	.....	.....	.....	10.59
Means	.....	.....	(0.86)	0.95	1.12	1.37	(1.16)	(0.98)	(0.80)	.....	.....
Departures	.....	.....	+0.09	+0.02	+0.02	+0.02	+0.06	+0.07	+0.01	.....	.....

[1] Extrapolated.

TABLE 2.—*Total solar radiation (direct+diffuse) received on a horizontal surface*

[Gram calories per square centimenter]

Week beginning	Average daily totals									
	Washington	Madison	Lincoln	Chicago	New York	Pittsburgh	Gainesville	Twin Falls	Fresno	La Jolla
1930										
June 4	429	478	580	381	289	414	.....	.....	746	425
June 11	482	412	535	368	374	525	.....	.....	723	254
June 18	590	545	611	416	429	527	456	.....	716	357
June 25	590	536	580	364	468	480	461	.....	757	508
Departures from weekly normals										
June 4	−54	−37	+50	−37	−114	.....	.....	.....	+47	+23
June 11	−18	−83	−3	−39	−28	.....	.....	.....	+18	−152
June 18	+110	+23	+49	+5	+36	.....	.....	.....	−14	−82
June 25	+73	−3	−6	−68	+62	.....	.....	.....	+21	+11
Accumulated departures on July 1	+2,849	−924	−721	+2,415	−259	.....	.....	.....	−1,009	−1,400

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent U. S. Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
1930	*H. m.*	°	°	°			
June 1 (Naval Observatory).	10 58	−41.5	259.5	+15.0	6	.....	.....
		−21.0	280.0	+17.0	139	.....	.....
		+39.5	340.5	+12.0	.....	62	207
June 2 (Naval Observatory).	10 46	−29.0	258.8	+15.0	.....	62	.....
		−8.5	279.3	+17.5	139	.....	.....
		+50.5	338.3	+11.5	12	.....	213
June 3 (Naval Observatory).	11 43	−62.5	211.6	−9.0	6	.....	.....
		−34.5	239.6	+1.5	3	.....	.....
		−14.0	260.1	+15.0	.....	25	.....
		+4.5	278.6	+17.5	123	.....	.....
		+66.0	340.1	+12.0	6	.....	163
June 4 (Naval Observatory).	10 54	−51.0	210.3*	−9.5	6	.....	.....
		−19.0	242.3	0.0	.....	6	.....
		−1.0	260.3	+15.0	.....	6	.....
		+17.5	278.8	+17.5	123	.....	.....
		+39.5	300.8	+17.0	2	.....	.....
		+76.0	337.3	+13.5	28	.....	171
June 5 (Naval Observatory).	10 50	−36.0	212.1	−9.5	.....	6	.....
		−5.5	242.6	+1.0	.....	46	.....
		+30.5	278.6	+17.5	123	.....	.....
		+43.5	291.6	−13.5	6	.....	181
June 6 (Naval Observatory).	10 48	−23.5	211.4	−10.0	.....	108	.....
		+9.0	243.9	+0.5	.....	108	.....
		+43.5	278.4	+17.5	123	.....	.....
		+56.5	291.4	−13.0	6	.....	345
June 7 (Naval Observatory).	13 18	−60.5	159.8	+15.0	15	.....	.....
		−43.0	177.3	−5.5	.....	12	.....
		−9.0	211.3	−10.0	.....	170	.....
		+25.0	245.3	0.0	.....	123	.....
		+57.0	277.3	+17.0	123	.....	443
June 8 (Naval Observatory).	13 30	−46.5	160.4	+14.0	.....	31	.....
		−30.0	176.9	−5.5	.....	46	.....
		+5.5	212.4	−10.0	.....	170	.....
		+39.5	246.4	+0.5	.....	139	.....
		+70.5	277.4	+17.5	123	.....	509
June 9 (Mount Wilson)	12 10	−35.0	159.4	+13.0	.....	48	.....
		−18.0	176.4	−6.0	.....	30	.....
		+18.0	212.4	−12.0	.....	227	.....
		+51.0	245.4	−1.0	.....	161	.....
		+72.0	266.4	+16.0	88	.....	554
June 10 (Naval Observatory).	10 53	−24.5	157.4	+13.5	.....	62	.....
		−5.5	176.4	−6.0	.....	25	.....
		+32.0	213.9	−11.0	.....	108	.....
		+65.5	247.4	−0.5	108	.....	303
June 11 (Naval Observatory).	10 52	−9.0	159.7	+13.0	.....	154	.....
		+7.0	175.7	−7.0	.....	6	.....
		+45.0	213.7	−11.5	.....	93	.....
		+78.0	246.7	−0.5	93	.....	346
June 12 (Naval Observatory).	11 3	+5.0	160.3	+13.0	.....	262	.....
		+21.0	176.3	−7.0	6	.....	.....
		+57.5	212.8	−11.0	.....	93	361
June 13 (Naval Observatory).	10 53	+18.5	160.7	+13.0	.....	201	.....
		+71.0	213.2	−11.0	.....	154	.....
		+71.5	213.7	+0.5	12	.....	367
June 14 (Naval Observatory).	10 15	+31.5	160.8	+13.5	.....	154	.....
		+79.5	208.8	−12.5	46	.....	200
June 15 (Naval Observatory).	10 23	+45.5	161.5	+13.5	.....	154	154
June 16 (Naval Observatory).	10 18	+59.5	162.3	+13.5	.....	123	123
June 17 (Naval Observatory).	10 29	+72.5	167.0	+13.5	.....	108	108
June 18 (Naval Observatory).	10 24	−6.0	70.3	+9.5	12	.....	12
June 19 (Naval Observatory).	10 32	+8.5	71.5	+9.5	6	.....	6
June 20 (Naval Observatory).	10 26	−63.5	346.3	+10.0	.....	31	31
June 21 (Naval Observatory).	10 19	−46.5	350.1	+10.0	.....	12	.....
		+17.0	53.6	−8.0	.....	9	21
June 22 (Naval Observatory).	10 20	−43.5	339.9	+8.0	3	.....	.....
		+32.0	55.4	−8.0	.....	9	12
June 23 (Naval Observatory).	10 30	−31.0	339.0	+12.5	.....	6	6

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longitude	Latitude	Spot	Group	
	H. m.	°	°	°			
June 24 (Naval Observatory).	10 23	−20.5	336.4	+15.0		37	
		+6.0	2.9	−9.0	6		43
June 25 (Naval Observatory).	10 22	−68.5	275.1	+17.5	12		
		−6.0	337.6	+15.0	9		
June 26 (Naval Observatory).	10 33	−55.5	274.8	+17.5	15		15
June 27 (Naval Observatory).	10 31	−73.5	243.6	+12.5	46		
		−50.0	267.1	+13.0		93	
		−43.5	273.6	+17.5	6		145
June 28 (Naval Observatory).	10 50	−61.5	242.2	+13.0		62	
		−37.5	266.2	+13.0		108	
		−30.0	273.7	+17.5	6		176
June 29 (Naval Observatory).	10 31	−48.5	242.1	+13.5		46	
		−26.0	264.6	+13.0		108	
		−17.5	273.1	+18.0	3		
	•	+3.0	293.6	+21.0	3		160
June 30 (Naval Observatory).	10 27	−35.0	242.4	+14.0		37	
		−12.5	264.9	+13.0		77	114
Mean daily area for June							184

PROVISIONAL SUN-SPOT RELATIVE NUMBERS, JUNE, 1930[1]

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

June, 1930	Relative numbers	June, 1930	Relative numbers	June, 1930	Relative numbers
1	31	11	52	21	8
2	28	12	a 42	22	8
3	a 28	13	37	23	7
4	Mc 34	14	23	24	10
5	27	15	21	25	16
6	Eac 34	16	20	26	14
7	Ec 70	17	16	27	Ec 32
8	a 70	18	15	28	28
9	61	19	9	29	29
10	52	20	14	30	31

Mean (30 days)=28.9.

[1] Dependent alone on observations at Zurich and its station at Arosa.
a=Passage of an average-sized group through the central meridian.
c=New formation of a large or average-sized center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.

AEROLOGICAL OBSERVATIONS

By RICHMOND T. ZOCH

Except for a few levels at Ellendale and Royal Center, the free-air temperatures at all the stations were below normal. (See Table 1.) However, in most cases the departures were small.

Free-air relative humidities were mostly below normal at all the stations. Free-air vapor pressures were also below normal at all the stations. The relative-humidity and vapor pressure departures were large.

The negative departures of all three elements are significant in that the precipitation at all the aerological stations except Broken Arrow was considerably below normal.

In the lower levels the resultant winds were southerly all over the country excepting the Allegheny Mountains and the Pacific coast. (See Table 3.) The resultant winds at the 3,000 meter level were northwesterly over the Mississippi Valley and westerly over the remainder of the country. At the 5,000-meter level the resultant winds were southerly over Florida and northwesterly over the remainder of the country.

On the 2d (see Table 4) Royal Center obtained the highest kite flight ever obtained at that station.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during June, 1930*

TEMPERATURE (° C.)

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	22.5	−2.4	24.0	−1.5	17.4	−1.3	22.7	−3.2	21.8	0.0
500	22.0	−0.9	21.6	−1.0	16.9	−1.4	21.5	−1.4	20.0	+1.1
1,000	20.1	0.0	18.2	−1.1	14.1	−1.2	19.6	−0.7	16.5	+0.9
1,500	17.1	−0.4	14.7	−1.3	11.8	−0.9	17.0	−1.1	12.9	+0.1
2,000	14.7	−0.1	11.3	−1.4	9.2	−0.6	14.8	−1.0	10.1	−0.1
2,500	11.8	−0.2	8.4	−1.2	6.5	−0.4	12.0	−1.2	7.1	−0.4
3,000	8.6	−0.4	5.7	−0.9	3.8	−0.3	9.6	−0.9	4.5	−0.3
4,000	−0.1	−2.9	−0.4	−1.0	−1.5	+0.1			−0.7	−0.5
5,000					−7.2	+0.3			−6.6	+0.1

RELATIVE HUMIDITY (%)

Surface	72	0	67	+2	68	−2	80	+5	61	−5
500	66	−6	66	−1	68	−1	73	−5	61	−7
1,000	60	−11	62	−6	65	−2	56	−16	61	−8
1,500	61	−6	63	−7	61	−3	48	−14	61	−6
2,000	56	−5	64	−6	56	−6	38	−16	57	−5
2,500	55	+1	61	−9	51	−10	36	−13	53	−3
3,000	55	+5	54	−13	47	−10	31	−15	50	−2
4,000	81	+32	61	+6	42	−8			45	+4
5,000					37	−13			39	−12

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during June, 1930*—Continued

VAPOR PRESSURE (*mb.*)

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	19.77	−2.85	19.35	−1.39	13.50	−1.79	22.00	−2.61	15.68	−1.64
500	17.51	−2.58	16.44	−1.74	13.20	−1.62	18.45	−3.26	14.12	−0.76
1,000	14.02	−2.52	12.64	−2.49	10.70	−1.03	12.39	−4.65	11.56	−0.93
1,500	11.80	−1.32	10.35	−2.30	8.68	−0.75	9.08	−3.69	9.28	−0.99
2,000	9.13	−0.88	8.37	−1.89	6.88	−0.72	6.45	−3.17	6.77	−1.13
2,500	7.17	−0.20	6.38	−1.95	5.26	−1.00	5.11	−2.39	4.92	−0.84
3,000	5.96	+0.38	4.65	−1.87	4.13	−0.70	3.97	−1.96	3.73	−0.56
4,000	6.37	+2.70	3.31	−0.08	2.46	−0.65	------	------	2.44	+0.26
5,000	------	------	------	------	2.03	−0.33	------	------	1.57	−0.16

TABLE 2.—*Free-air data obtained at naval air stations during June, 1930*

Altitude (meters) m. s. l.	Temperature (° C.)					Relative humidity (%)				
	Hampton Roads, Va.	Pensacola, Fla.	San Diego, Calif.	Seattle, Wash.	Washington, D. C.	Hampton Roads, Va.	Pensacola, Fla.	San Diego, Calif.	Seattle, Wash.	Washington, D. D.
Surface	24.4	23.8	20.4	17.5	24.9	75	83	69	63	62
500	21.8	22.8	16.6	13.0	21.9	69	74	81	69	60
1,000	18.8	20.3	18.4	9.7	19.0	65	68	54	71	58
2,000	12.9	14.2	18.5	4.4	13.3	56	65	17	69	55
3,000	7.1	9.1	12.1	−0.4	7.3	46	45	6	55	51
4,000	------	------	------	−4.6	------	------	------	------	46	------
5,000	------	------	------	−9.6	------	------	------	------	32	------

TABLE 3.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 7 a. m. (E. S. T.) during June, 1930*

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,873 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (139 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (65 meters)		Key West, Fla. (11 meters)		Los Angeles, Calif. (145 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°	
Surface	S 12 E	2.9	S 7 W	3.7	S 89 W	2.8	N 17 E	1.0	S 82 W	1.4	S 9 E	1.7	S 59 W	1.3	S 7 W	0.9	S 1 E	1.9	N 52 W	1.7
500	S 8 W	8.8	S 23 W	7.4	------	------	N 10 E	2.1	S 69 W	1.9	S 10 W	7.7	------	------	S 45 W	2.3	S 10 E	4.3	S 70 E	1.3
1,000	S 31 W	9.9	S 64 W	5.7	------	------	N 1 W	1.8	S 54 W	4.8	S 8 W	7.8	S 84 W	3.8	S 65 W	1.1	S 1 W	5.0	N 7 W	1.3
1,500	S 46 W	8.3	S 83 W	6.8	------	------	N 40 W	1.4	S 59 W	4.5	S 1 E	6.1	N 62 W	6.1	S 29 E	1.0	S 9 W	5.2	N 35 W	3.1
2,000	S 68 W	7.0	S 87 W	8.6	S 75 W	4.3	N 48 W	1.9	S 65 W	5.0	S	7.0	N 68 W	5.4	S 56 W	0.7	S 3 W	4.5	N 59 W	2.7
2,500	S 83 W	5.9	S 77 W	9.1	S 79 W	5.0	N 56 W	2.0	N 88 W	5.8	S 8 W	3.3	N 85 W	6.0	S 8 E	0.3	S 15 W	4.4	N 75 W	2.2
3,000	N 59 W	6.4	S 88 W	9.5	N 85 W	8.0	N 79 W	3.7	N 81 W	5.9	S 16 W	2.1	N 83 W	7.4	S 2 W	1.7	S 12 W	5.7	N 37 W	1.7
4,000	N 45 W	6.6	N 78 W	9.5	N 83 W	10.7	N 80 W	5.5	N 89 W	7.0	S 14 E	1.2	S 87 W	9.7	N 22 W	1.7	S 46 W	4.6	N 83 W	3.3
5,000	N 52 W	6.1	------	------	N 74 W	10.5	N 84 W	3.9	N 65 W	8.0	N 84 W	0.5	S 89 W	8.8	S 53 W	3.1	S 34 W	3.0	------	------

Altitude (meters) m. s. l.	Medford, Oreg. (410 meters)		Memphis, Tenn. (145 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (321 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,294 meters)		San Francisco, Calif. (8 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Washington, D. C. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°	
Surface	N 27 W	0.3	S 13 W	0.9	N 11 E	0.8	S 2 W	1.5	S 26 W	1.1	S 30 E	2.8	S 45 E	0.8	N 34 W	0.6	S 36 E	1.1	S 15 W	1.3
500	N 43 W	0.9	S 40 W	2.5	N 45 E	1.6	S 15 W	3.5	S 64 W	5.4	------	------	N 70 W	1.7	N 66 W	2.0	S 10 W	2.6	S 68 W	3.4
1,000	N 58 W	1.4	S 64 W	4.3	S 80 E	2.4	S 57 W	4.8	S 75 W	7.6	------	------	N 10 W	3.6	N 68 W	4.6	S 36 W	3.2	S 79 W	5.5
1,500	S 28 W	0.1	S 72 W	4.5	S 74 E	1.8	S 84 W	3.6	S 77 W	8.1	S 16 E	2.0	N 27 W	3.3	N 53 W	5.5	S 23 W	3.2	S 88 W	5.9
2,000	N 73 W	1.1	S 77 W	4.6	S 61 E	1.4	S 81 W	4.9	S 86 W	7.6	S 30 W	1.7	N 47 W	4.0	N 54 W	7.6	S 4 E	2.9	S 85 W	6.7
2,500	S 79 W	3.9	S 77 W	3.6	N 62 E	0.9	N 66 W	5.5	N 86 W	7.5	S 59 W	2.1	N 47 W	3.8	N 60 W	5.9	S 11 W	4.0	S 78 W	7.6
3,000	S 74 W	5.5	N 83 W	3.1	N 18 E	1.9	N 58 W	7.4	N 74 W	7.4	S 80 W	3.3	N 77 W	4.1	N 44 W	6.6	S 28 W	2.6	S 86 W	6.9
4,000	S 78 W	8.4	N 59 W	6.3	N 7 E	2.7	N 49 W	9.4	N 65 W	9.3	N 80 W	6.1	------	------	------	------	------	------	W	8.8
5,000	------	------	N 28 W	5.8	N 14 E	4.1	N 52 W	8.8	N 63 W	10.6	------	------	------	------	------	------	------	------	------	------

TABLE 4.—*Observations by means of kites, captive and limited-height sounding balloons during June, 1930*

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes (meters), m. s. l., reached during month	2,834	2,734	3,205	2,258	3,602
Maximum altitude (meters), m. s. l., reached and date	[1] 4,418	[2] 4,231	[3] 5,025	[4] 3,693	[5] 6,363
Number of flights made	29	20	33	28	29
Number of days on which flights were made	29	20	29	28	28

[1] 26th. [2] 2d. [3] 6th. [4] 19th. [5] 22d.

In addition to the above there were approximately 125 pilot balloon observations made daily at 53 Weather Bureau stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By M. C. BENNETT

GENERAL SUMMARY

The first half of June was unseasonably cold generally east of the Rocky Mountains, and the lowest temperatures of record for this month were recorded at a number of places, with freezing weather in portions of the Northwest. During the latter portion of the month, some unusually high temperatures occurred, with a considerable area extending from the northern Plains States to the southwestern border and the Gulf reporting temperatures of 100° or higher. While there was a decided difference in temperature during the early and latter portions of the month, the averages for the month as a whole were near normal for most sections of the country, except in New England and the Great Lakes region, where they were from 4° to 6° above normal.

The precipitation during the month was very local in character and unequally distributed, portions of southern Florida receiving two to three times the usual amount, while more than the normal was received along much of the Atlantic coast, the eastern and western portions of the Great Lakes, the upper Mississippi Valley, the southern Great Plains States, the extreme Northwest, and the far Southwest. Elsewhere the totals were generally below normal, much below in some sections. In the lower Mississippi Valley, and thence northeastward over the Ohio Valley, especially West Virginia and southwestern Virginia, very little rain fell during the month, and at the close of the month an unusually severe drought prevailed in West Virginia and some near-by sections. Scanty falls were also received from the Rocky Mountain region westward except in a few local areas.

TEMPERATURE

June included several periods of decidedly hot or cool weather for the time of year, and the temperature changes sometimes came abruptly.

The month began with cool weather over practically all the eastern half and much of the western half besides. Usually in the eastern, south-central, and southwestern portions, the lowest readings of the month were noted on the 1st or 2d, and in the Ohio and lower Mississippi Valleys and everywhere to eastward they closely approached or even surpassed the lowest June temperatures of previous record.

In the Lake region and the North and Middle Atlantic States, there was a quick warming very soon after the 1st, and in much of the Northeast the highest marks of the month were noted on or about the 5th. West of the Rocky Mountain Divide, also, warmth came before the month was far advanced. It was in the Plains region, the Mississippi Valley, and the principal cotton region that the tendency to lower than normal temperatures remained longest; indeed, about all of the South Atlantic and Gulf States and of the southern half of the Plains experienced cool weather till after the middle of the month.

The final fortnight of June was mainly a little cooler than normal near and to westward of the Rocky Mountains, except it was warmer in New Mexico and considerable portions of the States adjoining. Practically everywhere east of the Rocky Mountains this fortnight was hotter than normal, and notably so in the lower Mississippi Valley and most of the Southeast. The period from the 22d to the 26th brought temperatures that equaled or closely aj proached the highest marks of other Junes in the central valleys and practically everywhere to eastward and southward.

The month averaged warmer than normal almost everywhere along the northern border and in Colorado and New Mexico and thence westward. The departures were considerable only in New England and the northern Middle Atlantic States, where they were largely from 3° to 5°. In New England the month was the hottest June of record. The month averaged moderately cooler than normal in the far Northwest, also from Nebraska and Iowa southward and southeastward to the Gulf and South Atlantic coasts.

The highest mark so far reported is 121° on the 13th in southeastern California. The reading of 109°, seldom before reached in June east of the Mississippi River, was noted in Mississippi on the 26th, and there were but very few States where 97° or higher was not recorded at some station. The lowest temperature was 15° at an elevated point in Wyoming on the 14th. Freezing temperatures, or lower, were recorded at some point in most States from North Carolina, the Virginias, and Ohio northeastward, 22° in the mountains of Pennsylvania on the 1st being the lowest east of the Rocky Mountains.

PRECIPITATION

There was a decided shortage of precipitation, for the country as a whole. Fully three-fourths of the States averaged less than their normal June quantities, and several States of large crop production received less than half. For much of the Ohio and lower Mississippi Valleys it was the driest June of record.

The third decade usually brought less rain than either the first or the second decade.

The Florida peninsula had a marked excess of rain, and thence northward to New Jersey most districts close to the coast received more than normal.

Though the immediate vicinity of Lake Michigan had less rain than normal, yet many parts of Michigan and most of Wisconsin had considerably more than normal. Most of Iowa and northern Missouri had ample rainfall, also the greater part of the Plains region from eastern and south-central Nebraska to northern Texas. West of the Rocky Mountains considerable portions of Arizona, Utah, and Washington received more than normal.

As usual in June, California was practically without precipitation save one mountain district and the northernmost counties. From Oregon, northern California, and southern Washington eastward to northern Colorado, northwestern Nebraska, and South Dakota, much less than normal was usually received.

In the eastern half of the country the most notable area of deficiency extended from eastern Texas, western Arkansas, southeastern Missouri, and central Illinois eastward to and somewhat beyond the Appalachian crest. In large parts of Louisiana, Mississippi, and eastern Arkansas the rainfall was hardly appreciable, the month being one of the driest summer months ever experienced. Fortunately, most of this region had received liberal rain during May.

The vicinity of the Ohio River was less unfortunate in June than the immediate lower Mississippi Valley,

receiving, on the average, about two-fifths of the normal quantity; but it had received little rain during May.

In the entire country the greatest monthly amount reported was 25.34 inches, at Miami, Fla. In the portion west of the Mississippi River, the greatest measurement was 13.49 inches, at a station in Iowa.

SUNSHINE AND RELATIVE HUMIDITY

Much cloudy weather prevailed in the South Atlantic States, especially in the Florida peninsula, the southeastern portion of which received less than 20 per cent. of possible sunshine for the month. Likewise, much of the New England States, the northern portion of the Lake region, and the far Northwest received relatively small amounts of sunshine. On the other hand, from the Ohio and middle Mississippi Valleys to the Gulf and westward to the Pacific, except a small area in southern California, most localities received more than 70 per cent of sunshine, while the southwestern portions of Arizona and Nevada, and southeastern California received from 90 to 96 per cent of the possible amount for the month. The relative humidity, as would be expected, was generally below the normal over most sections of the country, except in New England, the lower South Atlantic States, some portions of the Lake region, and a few scattered localities in the central and western regions, where the humidity was somewhat above the average for the month.

SEVERE LOCAL STORMS, JUNE, 1930

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path (yards) [1]	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Raton and Sugarite, N. Mex.	1	1:30 p. m.			$25,000	Hail	Crops, buildings, and auto tops damaged	Official, U. S. Weather Bureau.
Jasper County, Iowa	2	3 p. m.			6,000	Tornado, wind, and hail.	No details reported	Do.
Garden County, Nebr. (southwestern).	2	4 p. m.	3 mi.			Hail	Crop damage varied from light to 50 per cent; path 15 miles long.	Do.
Merna, Nebr	2	5-6 p. m.	220			Tornado	Buildings demolished; path 3 miles long.	Do.
Frontier County, Nebr.	2	11 p. m.	1,760			Hail	Wheat damaged 35 to 75 per cent; path 25 miles long.	Do.
Adair, Adams, Boone, Marion, Polk, Warren, and Woodbury Counties, Iowa.	2	P. m.			93,000	Wind and hail	Character of damage not reported	Do.
Lake Tomahawk, Wis.	3	2:15 p. m.			900	Small tornado	Large trees uprooted, sheds wrecked	Do.
Carlsbad, N. Mex.	3	P. m.			5,000	Hail	Crops and building damaged	Do.
Lincoln County, Kans.	4	5 p. m.	3 mi.		6,500	do	Character of damage not reported	Do.
Rawlins County, Kans.	4	9 p. m.	1,760		15,000	do	do	Do.
Claflin, Kans.	4	11:30 p. m.	2 mi.			do	Wheat damaged 50 to 100 per cent; path 5 miles long.	Do.
Flagler, Colo.	4	P. m.	1,760		15,000	do	Considerable property damage over small area	Do.
Hiawatha, Kans.	5	3 p. m.			3,000	Wind	Many trees and poles blown down; small buildings damaged.	Do.
Midlothian, Ill.	5	3:30 p. m.				do	Wire services crippled; buildings badly damaged.	Do.
Chase, County, Nebr.	5	5 p. m.	2 mi.		2,000	Hail	Rye crop damaged 10 to 50 per cent; path 16 miles long.	Do.
Downing, Mo.	5				1,500	Wind	Several homes and barns unroofed; out-buildings blown down.	Do.
Lansing, Mich., and vicinity.	5		40-80		100,000	Tornado and hail	Farm buildings wrecked or damaged; forest trees leveled; crops badly injured.	Do.
Liberty, N. Y.	6	1 p. m.	880		5,000	Hail	Truck and other crops suffered	Do.
Florence, S. C.	6	P. m.	35			Small tornado	Dairy damaged; livestock killed or injured	Do.
Colmor, Levy, and Miami, N. Mex.	6	P. m.				Hail	Farm buildings and crops considerably damaged.	Do.
Roswell, N. Mex. (near)	6					Tornadic wind and hail.	Chief damage to crops	Do.
Amarillo, Tex. (near)	7	3 p. m.	2 mi.		75,000	Hail	Severe crop damage reported	Do.
Bushland, Tex. (near)	7	4 p. m.	2 mi.		50,000	do	Chief damage to crops; a few sheep killed	Do.
Rush, Barton and Rice Counties, Kans.	7	5 p. m.	5 mi.		75,000	do	Damage to wheat 100 per cent in some areas; length of path 60 miles.	Do.
Plainview, Tex. (near)	7	7 p. m.	2 mi.		62,500	do	Considerable crop injury; cattle killed	Do.
Tyrone, Okla.	7		2 mi.		50,300	do	Crops destroyed; path 10 miles long	Do.
Fort Hancock, Tex.	8	6 p. m.	1.5 mi.		55,000	do	Crops injured; windows broken; auto tops and roofs pierced.	Do.
Fort Laramie, Wyo. (near)	8				2,400	do	Crops injured	Do.
Hat Creek, Wyo. (near)	8					Tornado	3 houses demolished; telephone wires blown down.	Do.
Lansing to Mason, Mich.	8		3 mi.			Hail	Much destruction of property; path 10 miles long.	Do.
Webster County, Iowa	9	1 a. m.			3,500	Wind and hail	Character of damage not reported	Do.
Seward and Meade Counties, Kans.	9	2-3 p. m.	4-5 mi.		300,000	Hail	Extensive damage to crops, chiefly wheat; path 37 miles long.	Do.
Boone, Colo.	9	3 p. m.	3 mi.		50,000	do	Crops and roofs damaged	Do.
Porter, N. Mex. (near)	9	6 p. m.	1.5 mi.			do	2,000 acres of crops ruined	Do.
Tyrone, Okla., and vicinity	9		2 mi.		50,000	do	Heavy crop damage; considerable injury to other property.	Do.
Cortland to Syracuse, N. Y.	10	P. m.				Severe wind	Much damage to telephone and power lines; trees injured.	Do.
Sac and Webster Counties, Iowa.	11	A. m.			10,000	Hail and wind	Crops injured	Do.
Goodland, Kans., (near)	11	12:30 p. m.	1,760		5,000	Hail	do	Do.
Poweshiek County, Iowa	12	2 a. m.			3,000	Wind	Character of damage not reported	Do.
Park Falls, Wis.	12	6:45 p. m.	16		5,000	Tornado	All damage to property other than crops; path 2 to 3 miles long.	Do.
Pocahontas County, Iowa	13	10 a. m.			86,500	Wind and hail	No details reported	Do.
Woodbury County, Iowa	13	A. m.			347,750	2 tornadoes, wind and hail.	Greatest damage by hail; character not reported	Do.
Pierce and Buffalo Counties to Price and Marathon Counties, Wis.	13	5:30 p. m.			600,000	2 tornadoes, hail, wind and rain.	Many farm buildings wrecked; business houses and residences damaged; trees and poles blown down.	Do.
Polk and Butler Counties, Nebr.	13	6:30 p. m.	2 mi.			Hail	Crop loss ranged from 5 per cent to total in small area.	Do.
Palo Alto County, Iowa	13	7:30 p. m.			2,500	Wind and hail	No details reported	Do.
Sac County, Iowa	13	8 p. m.			14,000	do	do	Do.
Crawford County, Iowa	13	10:05 p. m.			15,050	Tornado	do	Do.
Monona County, Iowa	13	10:30 p. m.			12,000	Tornado and hail	do	Do.

[1] Mi. signifies miles instead of yards.

SEVERE LOCAL STORMS, JUNE, 1930—Continued

Place	Date	Time	Width of path (yards)	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Wright County, Iowa	13	11 p. m.			$8,000	Tornado	Path 14 miles long; 1 person injured; no other details.	Official, U. S. Weather Bureau.
Ida County, Iowa	13				95,500	Hail and wind	Character of damage not reported	Do.
Ellsworth to Edson, Wis.	13	P. m.	440-1,760	6	1,000,000	Tornado and hail	Many buildings damaged; heavy crop loss; path 80 miles long.	Do.
Bird Island, Sargeant, St. Paul Park and Randolph, Minn.	13			1	200,000	4 tornadoes	Extensive property damage; considerable portion of Randolph demolished; several persons injured.	Do.
Story County, Iowa	14	12:30 a. m.	334		2,000	Tornado	Path ¾ mile long; other details lacking	Do.
Butler County, Kans.	14	6 p. m.	2 mi.		6,000	Hail	Crops total loss in part of area; path 20 miles long.	Do.
Goodland, Kans. (near)	16	7 a. m.			5,000	do	Some damage to crops and other property	Do.
Scipio to Niles, N. Y.	16	3 p. m.	880			Hail and wind	Barns blown down; roofs and trees damaged; crops injured.	Do.
Grant County, Kans.	16	P. m.				do	Much wheat ruined; small buildings blown down or damaged.	Do.
Centerville, Ind. (near)	17	3:30 p. m.	1,760		11,000	Hail	Chief damage to crops	Do.
Pinebluff, Wyo. (near)	18	3:55 p. m.			4,000	do	Crops badly beaten.	Do.
Carbondale, Kans. (near)	19	A. m.	5 mi.			do	Heavy crop damage; path 6 miles long	Do.
Troy to Glen Falls, N. Y.	19	3 p. m.			100,000	do	Crop losses heavy; greenhouses, auto tops, and windows damaged.	Do.
Strasburg, Va.	19				5,000	Wind	Factory building destroyed	Do.
Bowdle to Broadland, S. Dak.	20	6-8 p. m.	2-3 mi.		150,000	Hail	Heavy damage to buildings and crops; poultry killed; path 90 miles long.	Do.
Ida County, Iowa	20	10 p. m.			5,000	Tornado	No details reported	Do.
Crawford and Emmet Counties, Iowa.	20				33,000	Hail	Crops and other property considerably damaged	Do.
Cochran, Ga.	21	4 p. m.	880		20,000	do	Crops suffered	Do.
Ashburn, Ga.	21	4:15-5 p. m.	1.5 mi.		40,000	do	Crops destroyed	Do.
Millville, Ga.	21	4:30 p. m.	1-2 mi.		10,000	do	Crops ruined	Do.
Doerun, Funston, and Moultrie, Ga.	21	5 p. m.			250,000	do	Crops ruined; other property damaged	Do.
Tifton, Ga.	21	do	1,760		20,000	do	Damage mostly to crops	Do.
Thomasville, Ga., and vicinity.	21	6:30 p. m.	do		30,000	do	do	Do.
Newbury, S. C. (near)	21				60,000	do	5,000 acres of crops damaged	Do.
Wilson County, Tenn.	21					Wind	Airplane wrecked; trees and poles blown down; path several miles long.	Do.
Benton County, Iowa	22	1-2 p. m.			6,000	Tornado and hail	Crops and buildings damaged	Do.
Bannock and Booneville Counties, Idaho.	22	2:15 p. m.	1-2 mi.		18,000	Hail	Cereal crops and fruit damaged; poultry injured	Do.
Booneville County, Idaho	22	7 p. m.	1,320		25,000	do	Crops hurt	Do.
Black Hawk, Buchanan, and Cherokee Counties, Iowa.	22				58,000	Wind and hail	Details not reported	Do.
Buffalo Gap, S. Dak.	23	6 p. m.			10,000	Hail	Crops, roofs, and windows damaged	Do.
Kenosha, Wis.	23	7 p. m.			1,000	Severe squall	Small houses and windmills damaged; path 1 mile long.	Do.
Houghton, Mich. (25 miles southwest).	23					Tornado	Much timber destroyed; barns and summer cottages wrecked; 6 children injured.	Do.
Evansville, Ind.	24	A. m.				Thunderstorm	Considerable damage to buildings and shade trees; electric system paralyzed.	Do.
Buffalo Gap to Fairburn, S. Dak.	24	3-4 p. m.	20 mi.		40,000	Wind and hail	Crops damaged; poultry killed; roofs and windows pierced.	Do.
Tiffin, Ohio, and vicinity	24	4 p. m.				Tornado	Large forest trees broken or uprooted; minor property damage.	Do.
Rush and Pratt Counties, Kans.	24	4-5 p. m.	4 mi.		15,000	Hail	Chief damage to wheat; path 15 miles long	Do.
Dawson County, Nebr.	24	6-7:30 p. m.	440-880	1	100,000	Tornado	Buildings on several farms demolished or damaged; path 30 miles long.	Do.
Pierre, S. Dak.	24	6:30 p. m.				Wind	Windows broken; trees, fences and electric wires blown down.	Do.
Kennebec to Kimball, S. Dak.	24	7-7:30 p. m.	4-8 mi.		100,000	Wind and hail	Wires blown down; buildings damaged; livestock injured.	Do.
Pratt, Kans.	24	7:45 p. m.	1,400		250,000	Tornado	Heavy damage on 7 farms; 2 persons injured; path 3 miles long.	Do.
Bertrand, Nebr. (near)	24	8 p. m.	440			do	Buildings on several farms wrecked	Do.
O'Brien County, Iowa	24	11-12 p. m.			50,000	Tornado and wind	No details reported	Do.
Sioux County, Iowa	24	do			55,000	Tornado, wind and hail.	5 persons injured; path short; other details lacking.	Do.
Anderson, S. C.	24	P. m.	250		9,500	Tornado	Farm buildings damaged; livestock injured	Do.
Greenwood, S. C.	24					Thunderstorm	Buildings damaged; livestock injured	Do.
Presho, S. Dak.	24	P. m.	880		3,000	Wind and hail	Some damage to crops and small buildings	Do.
Calhoun, Cherokee, Hamilton, Harrison, and Plymouth Counties, Iowa.	24				42,700	Hail and wind	Details not reported	Do.
Charleston, Tenn.	24					Wind	Barns and outhouses unroofed; trees uprooted	Do.
Henry and Halifax Counties, Va.	24					Wind, rain, and hail.	Crops and buildings suffered, especially near Martinsville and Clover.	Do.
Vermontville, Mich., and vicinity.	24		110		20,000	Tornadic winds and hail.	Several buildings unroofed and otherwise damaged; trees uprooted; path 2 miles long.	Do.
Aberdeen, S. Dak.	25	12:30-3 a. m.	440		50,000	Wind	Several small buildings destroyed, others damaged; telephone, telegraph, and electric light poles blown down.	Do.
Atchison County, Kans.	25	5-7 a. m.	1,200		3,000	Hail	No details reported	Do.
Hardin County, Iowa	25	1:30 p. m.	6		1,000	Tornado	Path 2,000 feet long; other details not reported	Do.
Midland County, Tex.	25	5 p. m.	4 mi.		16,000	Hail	5,000 acres of cotton ruined; minor property damage.	Do.
Sedan, Kans. (12 miles northwest).	25	6:30 p. m.	75		2,500	Tornado	Small buildings demolished; path 1 mile long	Do.
Meadville, Nebr. (near)	25	7 p. m.	440		75,000	Tornado and hail	Numerous farm buildings wrecked or damaged; some crop injury; path 15 miles long.	Do.
Evansville, Ind., and vicinity.	25	P. m.				Thunderstorm	Farm property destroyed; traffic delayed; serious damage to telephone lines.	Do.
Jackson, Union, Williamson, Johnson, Saline, Pope, and Hardin Counties, Ill.	25				60,000	Wind and electrical.	Buildings and orchards damaged; barn burned	Do.
Antelope County, Nebr.	26	4 a. m.	6 mi.		5,000	Hail	Many windows broken; siding damaged; path 6 miles long.	Do.
Moosic, Pa.	26	5:15 p. m.				Electrical	Mill at powder plant destroyed	Do.
O'Brien County, Iowa	26	9 p. m.			4,000	Hail and wind	Crops damaged	Do.
Wedgefield, S. C.	26	10 p. m.			12,000	Thunderstorm	Store burned	Do.

SEVERE LOCAL STORMS, JUNE, 1930—Continued

Place	Date	Time	Width of path (yards)	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Anne Arundel and Baltimore Counties, Md.	26					Electrical and wind.	Telephone and railroad signals thrown out of commission; buildings damaged or wrecked; trees uprooted.	Official, U. S. Weather Bureau.
Bridgeport, Pa.	26	P. m.	440			Probably tornado.	Over 50 buildings unroofed	Do.
Dauphin and Cumberland Counties, Pa.	26	do		1		Wind, hail, and electrical.	Several barns and other buildings wrecked; many tobacco sheds unroofed.	Do.
Lewis County, Idaho	27	3 p. m.	2 mi.		$125,000	Hail	Damage confined to crops, chiefly wheat	Do.
Meade County, Kans.	27	4:15 p. m.	5 mi.		200,000	do	Heavy wheat damage; path 9 miles long	Do.
Ford County, Kans.	27	5–6 p. m.	1–5 mi.		175,000	do	Chief damage to wheat; poultry and animals injured; path 25 miles long.	Do.
Abbeville and Youngsville, La.	27	5:40 p. m.			4,700	do	Cotton and corn stripped; auto tops and windows pierced.	Do.
Dill City, Okla.	27	9 p. m.	4 mi.		45,000	do	Damage chiefly to crops	Do.
Oldham, S. Dak.	28	8:30 p. m.	5 mi.		15,000	do	Crops suffered	Do.
Erwin, S. Dak.	29	1 a. m.	880–1,760		4,000	do	do	Do.
Winnebago, Waupaca, Calumet, and Manitowoc Counties, Wis.	29	6–7:30 p. m.		1	110,000	Wind and thunderstorm.	Many farm buildings damaged; some loss of crops.	Do.
Black Hawk, Bremer, Buchanan, Fremont, Hamilton, Howard and Winneshiek Counties, Iowa.	29				60,000	Wind and hail	Crops injured; buildings damaged	Do.
Mason to Wexford Counties, Mich.	29-30		135–200			Tornado	City and rural property damaged; Cadillac suffered greatest losses; path 55 miles.	Do.
Fremont County, Iowa	30	8:45 p. m.			4,000	Wind and hail	Crops injured	Do.
Mount Carroll and Granville, Ill.	30					Hail	Buildings and crops damaged	Do.

RIVERS AND FLOODS

By R. E. SPENCER

In the May, 1930, issue of this REVIEW it was stated that the only important damage done by the Arkansas and White River rises of that month was to prospective crops. A belated report of losses resulting from these floods gives the complete figures as follows:

	Black and White Rivers	Arkansas River
Tangible property	$10,000	$1,150
Prospective crops	8,500	35,000
Livestock	10	
Suspension of business		2,000
Total reported loss	56,660	
Value of property saved through Weather Bureau warnings	25,000	

Effects of the flood continuing from May in the Tallahatchie Basin appear in the table below. The overflow data are drawn largely from the results of a survey made by the Vicksburg, Miss., office of the Mississippi River Commission. No loss of life, or livestock or other movable property was reported.

County	Acres overflowed	Losses: Planting (actual loss)	Crops (prospective value)	Highways	Buildings	Land	Levees
Panola	[1] 950	Cotton, $1,400					$500
	[2] 1,850	Corn, $250					
Quitman	[1] 800	Cotton, $1,300					
	[2] 1,500	Corn, $150					
Tallahatchie	[1] 11,400	Cotton, $26,640					
	[2] 25,800	Corn, $2,360					
		Hay, $23,500					
Sunflower	[1] 4,000	Cotton, $12,000					
	[2] 8,000	Corn, $800					
		Hay, $7,500					
LeFlore	[1] 22,580	Cotton, $86,300	$280,000	$3,000			300
	[2] 28,820	Corn, $9,100	10,000				
		Hay, $19,725	34,000				
Grenada	[1] 2,500	Cotton, $7,000					
	[2] 4,500	Corn, $700					
		Hay, $7,000					
Carroll [3]	[1] 3,070	Cotton, $11,100	46,930	7,500	$1,500	$20,000	1,000
	[2] 3,760	Corn, $2,400	3,000				

[1] Improved land.
[2] Unimproved land.
[3] A large percentage of the damage in Carroll County was caused by breaks in the Palucia Creek levee. One break caused the covering of 200 acres with sand a foot deep. A sand bar formed below the largest of the breaks diverted the creek water across the Greenwood-Carrollton Highway near the Carroll-LeFlore County line, destroying the highway for a distance of a mile.

Relative to the flood in the Skunk, Des Moines, and Mississippi Rivers, the official in charge of the Weather Bureau office at Hannibal, Mo., reports as follows:

Excessively heavy rains in the Des Moines and Skunk Valleys in Iowa, on June 14 and 15, caused a severe flood in the Skunk River and slight flood conditions in the lower Des Moines, and the Mississippi as far south as Louisiana, Mo. The Skunk River was the highest ever known at Augusta, and the damage to growing crops was considerable. In the Des Moines and Mississippi Valleys the damage was not heavy, having been limited to the destruction of some small areas of crops in the low bottom lands and outside levees. All livestock had to be moved from island pastures.

Losses caused by this rise amounted to $5,000 in tangible property and $10,000 in prospective crops. Property worth about $10,000 was saved through the use of Weather Bureau warnings.

Except for slight losses (about $500) in the upper Smoky Hill River rise, damage from overflow along streams in the central United States upon which Weather Bureau gages are maintained was negligible. However, in Iowa (notably the southeastern quarter) and in Marathon County, Wis., between two and three million dollars damage was done to highways, bridges, and culverts by violently destructive rises in small streams—a usual result of heavy and concentrated summer-time rains.

The West Gulf Drainage floods, in most cases continuations from May, were discussed as necessary in the Review for that month, excepting the one in the Rio Grande following June 12. This rise did some slight damage to crops between the river and the levee in Cameron County, Tex.; and warnings were of considerable value in aiding levee protection work.

The Pacific Drainage floods were without important result.

Losses resulting from the lower Red River flood of May and June have not yet been reported.

[All dates in June unless otherwise specified]

River and station	Flood stage	Above flood stages—dates: From—	To—	Crest: State	Date
EAST GULF DRAINAGE					
	Feet			*Feet*	
Tombigbee: Lock No. 4, Demopolis, Ala.	39	(1)	3	54.3	May 28
Pearl: Jackson, Miss.	20	(1)	4	31.9	May 28
West Pearl: Pearl River, La.	13	(1)	12	15.4	May 24

[1] Continued from last month.

[All dates in June unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	State	Date
MISSISSIPPI DRAINAGE					
Mississippi:	*Feet*			*Feet*	
Keokuk, Iowa	14	18	18	14.0	18
Quincy, Ill	14	17	20	15.7	19
Hannibal, Mo	13	17	21	15.5	19
Louisiana, Mo	12	18	21	13.9	20
Wisconsin: Knowlton, Wis	12	15	16	15.5	15
Skunk: Augusta, Iowa	15	15	19	22.55	17
Des Moines:					
Tracy, Iowa	15	17	17	15.5	17
Ottumwa, Iowa	10	16	17	10.4	17
Smoky Hill: Lindsborg, Kans	21	7	7	23.6	7
Republican: Concordia, Kans	8	6	6	8.5	6
Osage: Osceola, Mo	20	16	17	20.6	16
Neosho:					
Oswego, Kans	17	12	12	18.4	12
Fort Gibson, Okla	22	17	17	22.0	17
Canadian: Logan, N. Mex	4	------	------	6.8	4
		------	------	5.0	8
		------	------	5.0	11
		------	------	5.0	18
North Canadian: Woodward, Okla	4	6	7	4.6	7
Tallahatchie: Swan Lake, Miss	25	(1)	13	30.3	May 29-30
Red: Alexandria, La	36	(1)	13	41.2	5-6
Ouachita: Monroe, La	40	2	11	40.6	6-7
WEST GULF DRAINAGE					
Sabine: Logansport, La	25	(1)	11	34.1	May 28-29
Trinity:					
Long Lake, Tex	40	(1)	2	46.7	May 23
Riverside, Tex	40	(1)	2	45.8	May 29
Liberty, Tex	25	(1)	14	27.9	3-5
Guadalupe: Victoria, Tex	16	20	20	16.3	20
Rio Grande:					
San Marcial, N. Mex	3	2	4	3.1	2
Riogrande, Tex	21	13	14	23.0	13
San Benito, Tex	23	(1)	2	23.6	2
		13	19	24.9	15
Brownsville, Tex	18	2	3	18.3	3
		14	16	18.4	14-15
PACIFIC DRAINAGE					
Colorado: Parker, Ariz	7	(1)	(2)	10.5	7, 17-20
Colorado, Roaring Fork: Carbondale, Colo	5	12	14	5.5	13
Gunnison: Delta, Colo	9	(1)	1	9.3	May 31
		13	13	9.0	13
Columbia: Marcus, Wash	24	12	18	24.4	14-15

[1] Continued from last month. [2] Continued at end of month.

EFFECT OF WEATHER ON CROPS AND FARMING OPERATIONS, JUNE, 1930

By J. B. KINCER

General summary.—During the first decade temperatures, notably at night, were too cool for best growth of vegetation rather generally east of the Rocky Mountains, especially for warm-weather crops such as corn and cotton. Some interruption to farm work was reported, but seasonal operations made generally good advance. Showers and locally generous rains afforded temporary relief in the formerly dry Atlantic area, but rainfall continued deficient over a considerable part of the interior, including West Virginia, most of Ohio, much of Kentucky and Tennessee, the eastern third of Missouri, and the southern portions of Illinois and Indiana.

During the second decade droughty conditions continued in the eastern and lower Ohio Valley and many south-central parts of the country, while the western half was practically rainless. Heavy to excessive rains in the lower Missouri and upper Mississippi Valleys and in parts of the Southwest were detrimental to outside operations, but in local areas the additional moisture was of great benefit. High temperatures locally served to intensify the droughty conditions, especially in Kentucky, while high, drying winds were reported from many districts of the Northwest.

During the last decade showers were helpful in many places in the Ohio Valley, but most upper-valley districts were still dry, with a good rain needed in many south-central sections of the country. Farm work made generally good advance, with very little interruption from rainfall; wheat harvest progressed northward to the central portions of Indiana, north-central Missouri, and in eastern Kansas nearly to the Nebraska border. Showers were beneficial rather generally over the northern parts of the country and in the middle Atlantic area, but further heavy rains in the Florida Peninsula were detrimental.

Small grains.—During the first decade the cutting of winter wheat with binders had begun north to northern Oklahoma and harvest had extended into the Texas Panhandle. Wheat was ripening in southeastern and southern Kansas, while progress was very good in Nebraska, with the crop heading well. Conditions were still unsatisfactory in the Ohio Valley, with progress and condition spotted, ranging from very poor to very good. The weather continued largely favorable in the Spring Wheat Belt, with the crop looking fine and well stooled and rooted. Oats and other small grains varied widely, especially oats in the Ohio Valley, where much short straw and thin stands were reported.

During the second decade conditions were, in the main, favorable for winter wheat harvest which was progressing as far north as central Illinois, southern Indiana, central Missouri, and southern Kansas. The crop was mostly poor to satisfactory in Ohio, where it was beginning to ripen, while dryness hastened maturity in Indiana. Much spring wheat was beaten down by heavy rains in Iowa, while some suffering from dryness was reported from northern and western South Dakota, but in general the crop did well. Cutting oats was well along in the South, but conditions were variable in many sections.

During the last decade winter wheat harvest progressed northward past the central parts of the Ohio Valley and to north-central Missouri and northern Kansas. Copious rains were very beneficial in Washington and parts of Oregon and good rains in South Dakota materially aided the spring wheat crop, which was heading. Slow growth was reported from some northern parts of the Spring Wheat Belt, but the crop was clean and of good color. Oats were heading very short in the southern Ohio Valley area, while harvest advanced almost as fast as winter wheat in the Southwest.

Corn.—During the first decade the weather was generally too cool for best growth of corn and advance was mostly only fair. Planting was practically completed but considerable replanted corn was not up and the cool weather retarded germination. Growth was good in the Southwest, but, in the Ohio Valley, a good warm rain was badly needed. Cultivation made fair progress, while in Iowa conditions had been favorable for weeds and the state of the crop varied considerably. During the second decade conditions favored cultivating and corn was mostly clean. In Iowa considerable was damaged by rain and hail; advance of the crop ranged from replanted second time to knee-high. Corn made generally good progress where rain was ample, but the crop deteriorated in central and southern Ohio due to the drought. It was satisfactory in parts of the western belt, but in the northwest the crop was somewhat late due to cool weather. In the middle Gulf States and adjacent sections rain was badly needed. During the last decade the reaction to warmer weather was favorable for growth of corn rather generally and the crop made good to excellent progress in most places, while conditions favored cultivation. It was still too dry, however, in parts of the Ohio Valley and eastern Missouri, and the

corn crop was late in the western belt. Advance was excellent in Iowa and the average condition was about normal; rains were helpful in the Atlantic States.

Cotton.—During the last decade temperatures were generally too low in the Southern States for good growth of cotton, but conditions were mostly favorable for cultivating and chopping. In Texas progress of the crop was poor to only fair due to cloudiness in the south and cool nights elsewhere, though cultivation made rapid advance and early plants were forming squares to the central portion. In Oklahoma planting was practically finished, but the crop was late and cultivation was poor. In central parts of the belt growth was slow, while in the Atlantic States showers were beneficial; squares were showing in early fields of South Carolina and in Georgia as far north as Augusta.

During the second decade temperatures were also too low for best development of cotton, while moisture was needed in much of the central area. General condition averaged only fair in Texas; there was some deterioration in the lower Rio Grande Valley due to frequent rains, but elsewhere advance was fairly good. In Oklahoma advance of early planted cotton was fairly good, but late-planted made only fair growth. Elsewhere west of the Mississippi River fair to fairly good progress was made. In central parts of the belt poor to only fair advance was indicated due to coolness and a general lack of sufficient moisture. In more eastern portions poor to good progress was made, with cotton well fruited in southern Georgia and the first bloom reported in South Carolina two days ahead of normal.

During the last decade warmer weather was favorable and cultivation made good advance; rain was needed in central sections of the belt. In Texas some improvement was reported from most districts, but the crop was still late, though early-planted was fruiting well. Progress was generally very good in Oklahoma, while in Arkansas advance was very good to excellent. Rain was needed in a good many places in the central belt, especially for the late-planted, while in the Atlantic States there was too much rain in parts, but in general the weather was favorable, with progress mostly good.

Miscellaneous crops.—The accumulating deficiencies of precipitation in the Mississippi Valley and many east-central parts of the country was detrimental to pastures and at the close of the month many were reported in poor condition. Except locally dry areas, the great western grazing areas were satisfactory, with livestock doing well generally. Dry weather also unfavorably affected truck and garden crops. Sugar beets made good advance, but the drought unfavorably affected cane in Louisiana. Fruits did well, except for some locally heavy dropping.

WEATHER OF THE ATLANTIC AND PACIFIC OCEANS

NORTH ATLANTIC OCEAN

By F. A. Young

The most unusual feature of the weather over the North Atlantic during the current month was the scarcity of cyclonic disturbances accompanied by winds of gale force. Among the large number of forms received from vessels up to time of writing, only eight rendered gale reports, with a maximum wind force as high as nine in only two cases. Gales were not reported on more than one day in any 5° square, and all but one occurred after the 16th.

As shown in Table 1, both departures and extremes of pressure were comparatively small at most of the stations, and slight gradients were the rule during the greater part of the month.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, 8 a. m. (seventy-fifth meridian). North Atlantic Ocean, June, 1930*

Stations	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Belle Isle, Newfoundland	29.87	[1] +0.03	30.58	10th	29.48	16th.
Halifax, Nova Scotia	29.99	[2] +0.02	30.50	10th [3]	29.54	22d.
Nantucket	30.00	[2] 0.00	30.34	12th	29.54	22d.
Hatteras	30.04	[2] +0.02	30.40	3d	29.70	22d.
Key West	29.97	[2] −0.02	30.10	30th	29.82	14th.
New Orleans	30.00	[2] 0.00	30.16	3d	29.80	17th.
Cape Gracias, Nicaragua	29.88	[1] −0.04	29.92	6th [3]	29.82	12th.[3]
Turks Island	30.07	[2] +0.06	30.18	30th	29.98	13th.
Bermuda	30.15	[2] +0.02	30.38	3d [3]	29.92	21st.[3]
Horta, Azores	30.29	[1] +0.08	30.48	9th	30.14	15th.[3]
Lerwick, Shetland Islands	29.89	[1] +0.09	30.43	15th	29.38	10th.
Valencia, Ireland	29.97	[1] −0.03	30.36	7th	29.55	30th.
London	30.00	[1] +0.07	30.27	15th	29.69	27th

[1] From normals shown on Hydrographic Office Pilot Charts, based on observations at Greenwich mean noon, or 7 a. m., seventy-fifth meridian time.
[2] From normals based on 8 a. m. observations.
[3] And on other date or dates.

Fog was unusually prevalent north of the fortieth parallel, west of the twentieth meridian, and also along the American coast between Hatteras and New York. The number of days in which it occurred in different sections of the ocean is as follows: Over the Grand Banks, from 20 to 23 days; along the American coast between the thirty-fifth and forty-fifth parallels, from 11 to 20 days; over the steamer lanes between the twenty-fifth and forty-fifth meridians, from 11 to 14 days; along the European coast from the thirty-fifth to fifty-fifth parallels, from 2 to 3 days.

Charts VIII to XI cover the period from the 23d to 26th, inclusive, and were drawn to show the conditions encountered by the airplane *Southern Cross* on her westward flight across the North Atlantic.

On the 1st St. Johns, Newfoundland, was near the center of a fairly well-developed LOW, and the Dutch S. S. *Gaasterdijk* some 300 miles south of the center encountered a moderate gale, as shown in table. According to reports received, this was the only gale occurring before the 17th of the month.

On the 1st a vessel off the south coast of Florida, near Miami, reported an easterly wind, force 7, barometer 30.11 inches.

On the 2d westerly to northwesterly winds of force 7 prevailed over the steamer lanes, between the thirtieth and sixtieth meridians, and the area of low pressure remained over Newfoundland.

During the greater part of the month the North Atlantic HIGH was well developed, and from the 3d to 8th high pressure was also the rule over the ocean generally, resulting in stagnant wind circulation. From the 9th to 11th the Icelandic LOW was comparatively active, and while the pressure gradient between the two centers of action was fairly steep during this period, few reports

of westerly wind of higher force than 6 were received from vessels in this region.

From the 12th to 16th an area of low pressure overspread the middle and eastern sections of the steamer lanes, but was accompanied by moderate westerly winds only. From the 17th to 21st favorable weather prevailed generally, except that on the 17th and 18th moderate gales occurred over limited areas in the east section of the steamer lanes and off the northwest coast of Cuba, respectively.

On the 22d and 23d a LOW over the Maritime Provinces was responsible for moderate gales in the easterly and southerly quadrants, the conditions on the 23d being shown on Chart VIII.

From the 24th to 28th moderate weather again prevailed over practically the entire ocean. On the 29th a LOW was central near 50° N., 20° W., and moderate to strong northwesterly gales were reported by vessels between the center and 40th meridian, and southerly winds of force 7 in the easterly quadrants.

OCEAN GALES AND STORMS, JUNE 1930

Vessel	Voyage		Position at time of lowest barometer		Gale began	Time of lowest barometer	Gale ended	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Highest force of wind and direction	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Inches*					
Gaasterdijk, Du. S. S.	Rotterdam	Boston	42 19 N	57 19 W	June 2	Noon, 2	June 2	29.83	SW	W, 8	NW	W, 8	
Bristol City, Br. S. S.	Fowey	Portland, Me.	48 12 N	32 15 W	June 17	10 p., 17	June 18	29.74	SW	SW, 7	WNW	WSW, 8	SW-W.
El Oriente, Am. S. S.	New York	Galveston	25 22 N	84 45 W	June 18	9 a., 18	do	29.81	S	S, 8	S	S, 8	Steady.
Exford, Am. S. S.	Gibraltar	Providence	41 18 N	51 34 W	June 22	10 a., 22	June 24	29.93	SSW	SW, 8	S	SW, 8	Do.
Exmouth, Am. S. S.	Casablanca	New York	40 40 N	47 00 W	June 21	—, 22	do	30.07	SSW	SSW, 6	W	S, 8	SSW-S.
Kendal Castle, Br. S. S.	Norfolk	Antwerp	39 10 N	59 54 W	June 22	Mdt., 22	June 23	29.91	SW	S, 9	SW	S, 9	SW-S-SW.
Caronia, Br. S. S.	Cobh	New York	44 34 N	40 36 W	June 25	1a., 26	June 26	29.97	SW	SW, 8	SW	SW, 8	Steady.
Mercier, Belg. S. S.	New York	Antwerp	47 50 N	23 02 W	June 29	3a., 30	June 30	29.70	WNW	NNW, 7	NNW	NW, 9	
NORTH PACIFIC OCEAN													
Golden Wall, Am. S. S.	Shanghai	San Francisco	43 15 N	166 30 E	June 3	2a., 4	June 4	29.49	S	SSW, 7	SSW	S, 8	
Do	do	do	44 30 N	166 10 W	June 7	10 p., 7	June 8	29.24	WSW	W, 7	WNW	WNW, 8	WSW-WNW.
Wisconsin, Am. S. S.	Portland	Hakodate	46 49 N	160 10 E	June 4	Noon, 4	June 5	29.10	WSW	WSW, 6	W	WNW, 8	Do.
Olympia, Am. S. S.	Taku Bar	Seattle	50 20 N	149 00 W	June 7	6 p., 8	June 8	28.91	ENE	NE, 8	NNE	ENE, 8	ENE-NNE.
Silverhazel, Br. M. S.	San Francisco	Manila	41 15 N	141 00 W	do	9 p., 8	June 9	29.61	SW	SSW, 9	W	SSW, 9	SSW-W.
Manoa, Am. S. S.	do	Honolulu	34 56 N	126 56 W	June 11	8 p., 11	June 12	29.73	WNW	WNW, 9		WNW, 9	
Reiyo Maru, Jap. S. S.	Portland	Yokohama	50 04 N	177 07 W	June 13	2 p., 14	June 15	28.80	SE	SSW, 9	W	SE, 10	SSW-SW.
Silverhazel, Br. S. S.	San Francisco	Manila	30 00 N	175 00 W	do	3 a., 14	do	29.91	S	S, 7	NW	S, 9	S-W-NW.
Taibun Maru, Jap. S. S.	Shimizu	Puget Sound	47 41 N	177 56 E	do	8 p., 14	June 16	28.93	ESE	W, 7	S	SW, 9	Variable.
Shikisan Maru, Jap. S. S.	Dairen	Los Angeles	33 22 N	124 30 E	June 14	8 a., 15	June 17	29.55	ENE	ENE, 7		NE, 8	E-ENE-NE.
Malolo, Am. S. S.	Honolulu	San Francisco	37 34 N	123 25 W	June 17	4 a., 19	June 19	29.80	NE	NW, 5	NW	NxE, 9	
Pres. Monroe, Am. S. S.	Manila	do	35 39 N	129 00 W	June 18	2 p., 19	do	30.00	NNE	N, 6	N	N, 8	NE-N.
Everett, Am. S. S.	Tacoma	Yokohama	52 30 N	159 15 W	June 21	8 p., 21	June 22	29.67	SE	SE, 8	S	SE, 8	SW-SE.
Do	do	do	51 18 N	172 39 W	June 23	8 a., 24	June 25	29.23	S	SSE, 8	SW	SE, 9	SW-ESE.
Pres. Hayes, Am. S. S.	Singapore	Manila	11 52 N	113 49 E	June 28	4 a., 30	July 1	29.51	SW	WSW, 8	SW	WSW, 9	WSW-SW.
REPORTS ON CYCLONE OFF WEST COAST OF MEXICO													
Willfaro, Am. S. S.	Los Angeles	Balboa	15 38 N	97 58 W	June 5	3 p., 5	June 6	29.74	E	E, –	SE	E, 8	Steady.
Drechtdyk, Du. M. S.	San Pedro	do	15 38 N	98 32 W	June 6	2 p., 6	do		E	E, 8	E	E, 8	Do.
Santa Veronica, Am. S. S.	Fort Allen, T. H.	do	13 12 N	98 48 W	do	2 p., 6	June 7	29.67	SE	SE, 7	SE	S, 7	SE-S.
Nora, Am. S. S.	San Pedro	Iquique	14 28 N	100 45 W	do	8 p., 6	do	29.72	NE	NE, 8	ESE	ESE, 9	NE-ESE.
Atlantic, Am. S. S.	New York	San Diego	18 15 N	104 17 W	June 4	2 a., 7	June 8	29.74	ESE	E, 8	ESE	E, 8	E-ESE-E.
Ecuador, Am. S. S.	San Francisco	Balboa	19 00 N	105 00 W	June 7	4 p., 7	do	29.74	SE	SE, 5	SE	SE, 8	Steady.
Astral, Am. S. S.	San Pedro	New York	21 00 N	107 10 W	June 9	4 a., 10	June 10	29.62	SE	SE, 9	S	S, 10	SE-SSE-S.
Atlantic Sun, Am. S. S.	do	Miami	21 15 N	108 00 W	June 10	Noon, 10	do	29.70	ESE	—, 9	SW	SE, 10	ESE-S.
San Felipe, Am. S. S.	do	Balboa	22 30 N	109 35 W	do	2 a., 10	do	29.47	NNE	NNE, 5	WSW	N, 7	NE-N.
Tamiahua, Am. S. S.	Long Beach	do	[1] 22 00 N	109 00 W	do	6 p., 10	June 11	29.14	E	Calm	WSW	NE, 10	ESE-O-SW.
Naples Maru, Jap. S. S.	San Pedro	do	21 30 N	109 05 W	do	5 p., 10	do	29.37	E	NNE, 11	SW	NNE, 11	E-N-SW.
Lena Luckenbach, Am. S. S.	do	do	22 01 N	108 52 W	do	8 p., 10	June 10	[2] 29.52	ENE	N, 10	NW	N, 10	NNE-N.
Noa, U. S. S.	Balboa	San Diego	21 13 N	108 53 W	do	5.30 p	June 11	29.08	SW	Light	NW	NW, 12	
William B. Preston, U. S. S.	do	do	Similar conditions.										
Hulbert, U. S. S.	do	do	do.	do.									
SOUTH PACIFIC OCEAN													
Frank G. Drum, Am. S. S.	San Pedro	Wellington	40 47 S	177 14 E	June 21	6 a, 21	June 21	29.21	NE	NE, 8	W	NE, 10	NNE-W.

[1] Approximate position. No sights taken.

[2] Barometer uncorrected.

NORTH PACIFIC OCEAN

By WILLIS E. HURD

Atmospheric pressure in June filled in considerably over that of May throughout the Aleutian region and the western part of the Gulf of Alaska. The barometer, however, continued abnormally low, although the departures from the average were much less than in the preceding month. The Aleutian Low, at no time very deep except about the middle of the month, when an active cyclone from the western Pacific entered its area, was central on the average over the Bering Sea and the closely adjacent waters to the southward in middle longitudes.

The North Pacific anticyclone on the average occupied a large area in middle latitudes, where it extended practically across the ocean, or to about the one-hundred-and-fiftieth meridian of east longitude westward from the American coast. In the Far East frequent small depressions disturbed the coastal region.

The following table gives barometric data for several island and coast stations in and bordering on the ocean in west longitudes:

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, at indicated hours, North Pacific Ocean, June, 1930*

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Dutch Harbor [1]	29.77	−0.22	30.24	13th	29.20	1st.
St. Paul [1]	29.77	−0.12	30.24	13th	29.24	26th.
Kodiak [1 2]	29.88	−0.06	30.34	18th	29.06	9th.
Midway Island [1]	30.14	+0.07	30.26	5th [3]	29.98	18th.[3]
Honolulu [4]	30.03	−0.01	30.13	1st	29.91	28th.
Juneau [4]	29.96	−0.05	30.38	18th	29.18	9th.
Tatoosh Island [4 5]	30.06	+0.01	30.30	16th	29.65	15th.
San Francisco [4 5]	29.92	−0.04	30.12	26th	29.67	11th.
San Diego [4 5]	29.90	+0.01	30.04	26th	29.72	11th.

[1] P. m. observations only.
[2] For 29 days.
[3] And on other dates.
[4] A. m. and p. m. observations.
[5] Corrected to 24-hour mean.

For the most part typical June weather prevailed over all parts of the ocean, and gales were comparatively infrequent and of moderate character, very few exceeding 8 or 9 in force. Along the upper steamship routes vessels reported gales in and near the Aleutian region on ten or twelve days. Those of the 13th to 15th and the 24th to 25th were the more severe, with local maximum winds forces of 10 on the 14th and 9 on the other dates, these occurring south of the central Aleutians. Gales were most widespread on the 14th, on which date they were encountered between the thirty-eighth and fifty-first parallels in midocean. Off the central and upper California coast, and thence as far westward as the meridian of 130° W., gale periods occurred on the 11th–12th and the 18th–19th, the highest winds reported being of force 9. On the 19th fresh gales were encountered as far north as Tatoosh Island at about 200 miles offshore. Elsewhere in middle and upper waters such few gales as occurred were local and unimportant.

A severe local thunderstorm, accompanied by a fresh southeast gale and torrential rain, was experienced during the early morning of the 22d, in 11° 17′ N., 89° 11′ W., by the American steamer *F. H. Hillman*.

In the Asiatic tropics a typhoon which originated during May terminated its existence west of Japan on June 1. Gales occurred in the lower China Sea on the 29th and 30th, becoming strong on the latter date, and continuing of force 9 on July 1. Pressure in the disturbed region, as reported by the American steamer *President Hayes*, dropped to 29.51 inches. Little further is known at this writing of the disturbance that occasioned the gales beyond the fact that a general depression covered the Philippines and adjacent waters on the 30th.

The prevailing wind direction at Honolulu was from the east, with the average hourly wind velocity, 9.4 miles, practically normal for the month. The highest velocity recorded was at the rate of 24 miles an hour from the east on the 27th.

There were two principal fog regions of considerable extent over the ocean. The larger and more important, with 25 to 40 per cent of days with fog, extended from the Kuril Islands to a distance of approximately 800 miles southeastward. The other, with 10 to 15 or 20 per cent of days with fog, lay south of the Gulf of Alaska along the northern trans-Pacific routes. Scattered local fogs, occurring on one to four days in a given small area, were observed in various other parts of the ocean north of the thirtieth parallel. About 20 per cent of the days had fog along the California coast, and thick local fogs were experienced on three days off the southern part of Lower California.

Mexican west coast hurricane.—In the tropics there occurred at least one cyclone of consequence. This was the hurricane of June 4–11 which originated well to the southward of the Gulf of Tehuantepec, ran at some distance off the west Mexican coast, and finally went inland after crossing the mouth of the Gulf of California.

During the early stages of this storm, such vessels as were caught within the region of its gales (as indicated in the table of Ocean Gales and Storms) experienced little more than easterly and southeasterly winds with slightly depressed barometer. While the data from seamen's reports showed the progress of the cyclone from near 12° N., 92° W., up to the mouth of the Gulf of California, not a vessel from the 4th to the 9th entered the storm area on its western side, except the American tanker *Nora*, which crossed the storm front on the 7th.

On the 10th, however, all vessels which passed Cape San Lucas were more or less involved on all sides, and three destroyers of the United States Battle Fleet—the *William B. Preston*, the *Hulbert*, and the *Noa*—passed through the center of the cyclone, which was now of hurricane force. The American steamers *Astral*, *Atlantic Sun*, *Lena Luckenbach*, *San Felipe*, and *Tamiahua*, and the Japanese steamer *Naples Maru*, experienced gales of force 10 to 11 near or at the entrance to the Gulf.

In passing through the storm center, the lowest pressure reading in which was 29.08 inches, made in 21° 13′ N., 108° 53′ W., at 5.30 p. m. of the 10th by the destroyer *Noa*, the clear eye of the storm was observed and sun sights were made. This is the first instance on record known to the writer of a clear central sky being observed in a cyclone of this coast.

On the 11th the storm went ashore north of Mazatlan and rapidly dissipated. Some damage was done in Mazatlan due to high winds and inundation, according to press reports.

CLIMATOLOGICAL TABLES

(For description of tables and charts, see REVIEW, January, 1930, p. 37)

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Condensed climatological summary of temperature and precipitation by sections, June, 1930

Section	Temperature								Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	77.4	−0.9	2 stations	108	[1] 24	St. Bernard	41	1	1.95	−2.31	Alaga	5.36	Bridgeport	0.06
Arizona	76.5	+0.5	Gila Bend	116	28	Heber Ranger Station.	20	1	0.46	+0.07	Rosemont	3.78	12 stations	0.00
Arkansas	76.4	−0.7	Magnolia	107	26	2 stations	39	[1] 1	0.87	−3.15	Gravette	6.20	Mammoth Springs	0.00
California	68.0	+0.5	Greenland Ranch	121	13	Ellery Lake	19	2	0.03	−0.28	Mount Shasta	0.80	175 stations	0.00
Colorado	62.1	+0.8	Cheyenne Wells	105	28	Pearl	17	[1] 14	0.74	−0.77	Holyoke	3.03	4 stations	0.00
Florida	77.9	−1.9	2 stations	107	24	Hilliard	50	1	10.72	+3.99	Miami	25.34	Panama City	0.57
Georgia	76.2	−1.8	do	106	24	Clayton	38	1	3.84	−0.57	Waycross	8.97	Tallapoosa	0.90
Idaho	59.5	−1.1	do	101	16	Obsidian	20	14	0.90	−0.47	2 stations	2.99	Prairie	0.00
Illinois	71.7	−0.2	5 stations	104	[1] 22	2 stations	37	8	3.37	−0.50	Mount Carroll	8.13	Chester	1.04
Indiana	71.0	−0.6	3 stations	102	23	Marengo	35	1	2.60	−1.23	Noblesville	5.26	Moores Hill	0.58
Iowa	69.0	−0.3	2 stations	101	22	Denison	37	8	5.83	+1.33	Washington	13.49	Spencer	2.48
Kansas	72.7	−0.5	Jetmore	110	28	Atwood	40	6	3.92	−0.69	Coffeyville	10.64	Macksville	1.04
Kentucky	73.1	−0.7	Bowling Green	104	23	Dorton	38	1	1.77	−2.48	Uniontown	3.89	Ford	0.53
Louisiana	79.0	−1.1	Ville Platte	107	[1] 26	4 stations	47	[1] 1	0.62	−4.19	Jennings	1.72	3 stations	0.00
Maryland-Delaware	72.2	+1.3	Keedysville, Md	99	[1] 4	Oakland, Md	26	1	3.27	−0.66	Emmitsburg, Md	5.95	Millington, Md	1.36
Michigan	65.3	+1.4	Cassopolis	97	23	Sidnaw	29	10	3.33	+0.27	Alpena	6.95	Holland	1.34
Minnesota	65.3	+1.3	Redwood Falls	98	21	2 stations	32	7	3.90	−0.24	Albert Lea	8.87	Fergus Falls	1.29
Mississippi	78.1	−0.6	Waynesboro	109	26	do	45	[1] 1	0.55	−3.70	Biloxi	4.31	4 stations	0.00
Missouri	72.4	−0.8	Sikeston	109	22	Goodland	36	1	3.83	−1.04	Hannibal	10.35	Marble Hill	0.30
Montana	60.2	+0.5	Crow Agency	104	16	Grant	23	14	1.51	−1.09	Scobey	5.53	Three Forks	0.33
Nebraska	68.2	−0.8	Merriman	105	21	2 stations	32	[1] 6	3.22	−0.56	Osceola	6.39	Sheep Creek Camp No. 5.	0.37
Nevada	66.5	+1.5	Las Vegas	113	[1] 11	Lamoille	23	3	0.16	−0.34	Tuscarora	0.83	15 stations	0.00
New England	68.4	+4.6	3 stations	97	[1] 6	3 stations	29	[1] 1	3.39	+0.06	Springfield, Mass	9.48	Bar Harbor, Me	0.15
New Jersey	70.8	+2.6	Somerville	98	4	Belleplain	30	1	4.17	+0.47	Moorestown	6.48	Pleasantville	2.46
New Mexico	69.1	+0.8	3 stations	109	[1] 28	Selsor Ranch	19	1	1.04	−0.33	Nara Visa (near)	5.24	4 stations	0.00
New York	67.6	+2.9	Troy	99	5	2 stations	27	[1] 1	4.33	+0.63	McKeever	7.03	Little Falls (No. 2)	2.03
North Carolina	72.0	−1.1	2 stations	103	24	Banners Elk	27	1	4.75	−0.10	Manteo	10.00	Murphy	1.62
North Dakota	63.3	+0.5	Lisbon	96	21	Pembina	30	6	3.09	−0.41	Berthold Agency	6.71	Verona	0.13
Ohio	70.0	+0.9	4 stations	101	[1] 23	2 stations	32	1	2.34	−1.55	Sidney	5.64	Chillicothe	0.29
Oklahoma	77.0	−0.2	2 stations	111	25	Smithville	42	1	3.74	−0.29	Pawhuska	8.84	Antlers	0.12
Oregon	59.3	−1.1	do	102	15	Lake	17	18	0.76	−0.49	2 stations	3.21	Echo	0.00
Pennsylvania	69.1	+0.9	Holtwood	100	5	Somerset	22	1	4.20	+0.10	Center Hall	13.02	Pottstown	1.56
South Carolina	75.1	−2.4	4 stations	104	24	5 stations	42	1	4.40	−0.45	Pinopolis	7.67	Society Hill	2.27
South Dakota	66.1	0.0	2 stations	105	28	Hermosa	36	6	2.63	−0.79	Camp Crook	6.17	Ottumwa	0.26
Tennessee	74.4	−0.1	Carthage	105	23	3 stations	38	1	1.42	−2.90	Rogersville	3.35	Moscow	0.06
Texas	79.4	−0.7	3 stations	110	[1] 25	4 stations	48	[1] 1	2.14	−1.13	Haskell	8.98	4 stations	0.00
Utah	65.5	+0.7	St. George	106	[1] 12	Woodruff	24	14	0.45	−0.16	Alton	1.71	Jensen	0.00
Virginia	72.1	+0.5	2 stations	103	24	Burkes Garden	26	1	3.31	−0.98	Runnymede	6.93	Wytheville	0.91
Washington	58.9	−1.7	Kiona	99	6	Bumping Lake	26	13	1.52	−0.13	Big Four	8.97	2 stations	0.00
West Virginia	68.9	−0.2	Romney	104	5	2 stations	27	1	2.87	−1.60	Bruceton Mills	6.42	Dam 26, Ohio River	0.95
Wisconsin	66.4	+1.7	Milwaukee County Airport	100	23	Big St. Germain Dam.	28	17	5.28	+1.30	Neillsville	11.39	Milwaukee County Airport.	1.49
Wyoming	58.7	−0.6	Douglas	98	28	Gallatin	15	14	1.09	−0.46	Knowles	6.04	Diversion Dam	0.06
Alaska [May]	42.3	+0.2	Fairbanks (near)	81	[1] 29	Savoonga	4	8	1.69	−0.11	Chignik	35.71	McKinley Park	0.00
Hawaii	73.4	−0.2	2 stations	92	[1] 2	2 stations	52	[1] 8	8.19	+3.03	Puu Kukui (upper)	47.00	13 stations	0.00
Porto Rico	77.6	−0.8	Manati	98	1	Guineo Reservoir	47	12	4.86	−1.38	San Sebastian	14.70	Sabana Grande	0.60

[1] Other dates also.

TABLE 1.—*Climatological data for Weather Bureau stations, June, 1930*

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with .01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
New England							67.7	+4.2										78	2.62	−0.4										5.5		
Eastport	76	67	85	29.86	29.94	+0.01	57.6	+2.5	88	15	67	39	1	48	40	54	52	85	1.70	−1.3	10	4,976	s.	30	nw.	1	2	11	17	7.5	0.0	0.0
Greenville, Me	1,070	6	----	28.78	29.93	------	65.4	------	88	6	76	36	2	55	36	----	----	----	4.48	------	17	3,703	se.	----	----	----	14	1	15	----	0.0	0.0
Portland, Me	103	82	117	29.83	29.95	−.00	66.4	+3.9	92	4	75	42	1	58	35	60	56	73	1.96	−1.3	12	5,379	s.	34	nw.	1	16	5	9	4.6	0.0	0.0
Concord	289	70	79	29.64	29.94	−.02	69.2	+6.3	93	5	81	34	1	57	44	----	----	----	1.89	−1.3	11	3,661	se.	27	w.	1	11	7	12	5.8	0.0	0.0
Burlington	403	11	48	29.47	29.90	−.06	68.8	+3.1	88	5	78	37	2	60	33	----	----	----	3.90	+0.5	11	6,444	s.	31	se.	10	4	15	11	6.8	0.0	0.0
Northfield	876	12	60	----	29.92	−.04	66.2	+4.9	89	6	78	31	2	54	42	----	----	74	4.99	+1.8	12	3,703	s.	21	s.	6	2	20	8	6.4	0.0	0.0
Boston	125	106	165	29.82	29.95	−.01	72.4	+5.9	95	5	82	45	1	63	35	64	60	70	2.24	−0.6	11	5,237	sw.	26	w.	1	11	11	8	5.3	0.0	0.0
Nantucket	12	14	90	29.97	29.98	.00	65.7	+4.7	84	26	72	44	1	59	20	61	60	86	0.49	−2.2	4	10,437	sw.	42	sw.	1	15	9	6	4.3	0.0	0.0
Block Island	26	11	46	29.94	29.97	.00	65.0	+3.2	80	25	71	48	1	59	19	61	59	87	2.00	−0.6	8	10,009	sw.	36	w.	1	8	11	11	5.8	0.0	0.0
Providence	160	215	251	29.80	29.96	−.01	71.4	+3.1	93	4	81	44	1	62	36	64	60	70	2.71	0.0	11	7,121	sw.	39	nw.	1	14	9	7	4.6	0.0	0.0
Hartford	159	122	----	29.79	29.96	−.01	71.8	+4.7	94	5	82	53	3	62	37	----	----	----	4.54	+1.5	12	----	sw.	----	----	----	11	12	7	4.9	0.0	0.0
New Haven	106	74	153	29.86	29.97	.00	70.4	+3.8	93	4	79	44	1	62	38	64	60	75	2.43	−0.7	10	5,464	s.	30	sw.	1	11	13	6	4.8	0.0	0.0
Middle Atlantic States							72.3	+2.0										69	3.92	+0.3									4.6		
Albany	97	107	115	29.83	29.93	−.04	72.2	+4.2	96	5	83	44	1	62	34	65	61	72	3.21	−0.2	10	4,520	s.	23	s.	6	15	12	3	3.7	0.0	0.0
Binghamton	871	10	84	29.04	29.96	−.01	69.0	+3.4	92	5	81	40	1	57	38	----	----	----	5.89	+2.5	10	3,666	sw.	22	se.	10	14	6	10	4.8	0.0	0.0
New York	314	414	454	29.64	29.97	−.01	71.8	+3.0	90	5	80	48	1	64	27	64	60	73	2.60	−0.7	10	9,773	s.	52	se.	10	7	15	8	5.7	0.0	0.0
Bellefonte	1,050	5	36	28.88	29.97	------	66.6	------	90	5	80	33	1	53	44	60	56	68	5.67	------	11	----	sw.	----	----	----	11	13	6	4.9	0.0	0.0
Harrisburg	374	94	104	29.59	29.98	−.01	72.8	+2.5	95	4	83	45	1	62	35	63	58	63	5.38	+1.8	9	4,124	w.	31	nw.	21	15	10	5	4.1	0.0	0.0
Philadelphia	114	123	367	29.87	29.99	+.01	75.2	+3.8	94	26	84	51	1	66	28	65	59	64	4.96	+1.7	11	8,295	sw.	51	nw.	26	9	15	6	5.1	0.0	0.0
Reading	325	81	98	29.63	29.97	------	73.6	+3.8	94	26	84	47	1	63	32	64	58	61	2.55	−1.0	8	3,935	sw.	20	se.	10	14	12	4	4.1	0.0	0.0
Scranton	805	111	119	29.13	29.97	−.01	69.8	+2.0	92	5	82	42	1	58	38	62	56	64	2.83	−0.8	9	4,434	sw.	21	se.	10	8	17	5	4.7	0.0	0.0
Atlantic City	52	37	172	29.93	29.99	+.01	69.7	+3.1	90	25	76	49	1	64	27	64	62	80	5.04	+2.0	10	10,540	s.	52	se.	10	7	14	9	5.0	0.0	0.0
Cape May	17	13	49	----	----	------	69.6	+1.9	88	25	77	45	1	62	31	65	63	84	3.20	+0.2	9	----	se.	----	----	----	11	12	7	----	0.0	0.0
Sandy Hook	22	10	55	29.94	29.96	------	71.0	------	91	4	78	51	1	64	33	64	61	78	3.32	−0.5	12	7,871	sw.	37	sw.	26	8	14	8	5.1	0.0	0.0
Trenton	190	159	183	29.77	29.97	------	73.0	+3.5	94	26	83	46	1	62	33	65	60	67	4.25	+1.2	11	6,442	sw.	31	se.	10	10	12	8	5.0	0.0	0.0
Baltimore	123	100	215	29.85	29.97	−.02	76.2	+3.5	96	4	86	51	1	67	32	65	59	61	2.97	−0.9	9	6,582	sw.	33	sw.	26	13	12	5	4.6	0.0	0.0
Washington	112	62	85	29.87	29.98	−.02	75.1	+2.9	97	26	86	45	1	64	38	65	60	62	3.19	−0.9	8	3,551	sw.	22	nw.	19	13	13	4	4.0	0.0	0.0
Cape Henry	18	8	54	29.98	30.00	------	73.4	+0.5	95	24	81	50	1	66	27	68	66	79	6.68	+2.7	8	6,020	sw.	38	n.	24	13	10	7	4.6	0.0	0.0
Lynchburg	681	153	188	29.28	30.02	+.01	72.7	−1.9	98	24	84	44	1	61	39	64	58	62	2.57	−1.2	7	3,950	w.	42	nw.	26	15	10	5	4.1	0.0	0.0
Norfolk	91	170	205	29.92	30.02	+.02	75.0	+0.6	94	26	84	53	1	66	29	67	64	73	5.90	+1.7	8	7,088	s.	36	nw.	26	11	9	10	4.9	0.0	0.0
Richmond	144	11	52	29.85	30.00	−.01	74.2	+0.1	96	26	85	45	1	64	37	67	63	73	5.18	+1.3	10	4,164	sw.	40	nw.	26	10	14	6	4.6	0.0	0.0
Wytheville	2,304	49	55	27.69	30.00	−.01	66.2	−2.5	92	24	79	37	1	54	40	59	54	64	0.91	−3.3	8	3,338	nw.	28	w.	24	17	9	4	3.8	0.0	0.0
South Atlantic States							75.3	−1.2										73	5.06	+0.4									5.4		
Asheville	2,253	70	84	27.72	30.02	+.01	68.0	−0.7	93	26	78	41	1	58	36	60	56	69	2.96	−1.0	11	4,424	se.	26	n.	26	14	12	4	4.1	0.0	0.0
Charlotte	779	55	62	29.20	30.02	+.01	75.2	−0.3	102	24	86	52	1	65	31	65	59	64	4.92	+0.7	9	2,538	s.	25	nw.	26	9	13	8	5.5	0.0	0.0
Greensboro	886	5	56	29.09	30.03	------	72.2	------	100	24	85	42	1	59	39	65	62	73	2.66	------	13	4,385	s.	36	w.	24	8	12	10	5.1	0.0	0.0
Hatteras	11	5	50	30.01	30.02	+.01	75.0	−0.6	87	25	81	53	1	69	21	71	69	81	7.78	+3.3	13	6,791	sw.	28	w.	9	13	10	7	4.2	0.0	0.0
Raleigh	376	103	110	29.62	30.01	.00	74.8	−0.9	99	24	85	52	1	65	31	67	63	71	4.24	−0.2	13	4,258	sw.	31	nw.	26	9	12	9	5.2	0.0	0.0
Wilmington	78	81	91	29.95	30.03	+.02	75.2	−1.6	93	23	83	54	1	67	24	70	68	80	3.89	−1.2	14	5,355	sw.	26	w.	27	10	12	8	5.4	0.0	0.0
Charleston	48	11	92	29.97	30.02	+.01	76.8	−2.1	95	20	83	61	1	71	23	72	69	80	6.59	+2.0	15	6,635	s.	31	e.	14	7	5	18	6.5	0.0	0.0
Columbia, S. C	351	41	57	29.64	30.01	.00	75.9	−2.2	100	24	86	50	1	66	31	67	63	69	3.98	−0.2	14	3,982	s.	29	sw.	26	9	13	8	5.5	0.0	0.0
Due West	711	10	55	29.28	30.05	------	75.4	------	102	24	86	53	10	64	32	----	----	----	2.59	------	12	4,859	e.	28	nw.	26	9	11	10	5.3	0.0	0.0
Greenville, S. C	1,039	139	146	28.93	30.00	------	74.9	+0.8	99	24	85	53	10	65	28	65	60	65	5.23	+0.7	11	4,538	ne.	24	w.	26	9	12	9	5.1	0.0	0.0
Augusta	182	62	77	29.80	29.99	−.02	78.0	−0.7	102	24	88	50	1	68	33	68	64	68	2.49	−2.2	10	3,421	s.	19	e.	15	10	14	6	5.1	0.0	0.0
Savannah	65	150	194	29.93	30.00	−.01	77.4	−1.6	97	23	85	60	1	70	23	71	68	79	3.42	−1.9	14	6,777	e.	35	nw.	25	10	4	16	5.9	0.0	0.0
Jacksonville	43	209	245	29.95	30.00	−.01	76.9	−3.0	94	23	83	64	9	70	24	70	68	79	10.13	+4.8	14	7,005	s.	33	se.	28	3	11	16	7.1	0.0	0.0
Florida Peninsula							79.2	−1.5										81	15.79	+9.7									7.0		
Key West	22	10	64	29.94	29.96	−.03	80.0	−1.9	89	28	85	69	15	75	17	75	74	81	12.97	+8.7	16	6,258	e.	35	sw.	18	6	6	18	7.2	0.0	0.0
Miami	25	124	168	29.97	30.00	−.01	79.2	−0.8	91	23	85	68	2	74	17	75	73	81	25.34	+18.5	18	6,640	e.	31	s.	17	2	7	21	8.1	0.0	0.0
Tampa	35	79	197	29.95	29.99	−.02	78.5	−1.7	93	24	86	65	8	71	20	72	70	81	9.06	+1.8	16	7,340	e.	32	s.	18	3	10	17	7.1	0.0	0.0
Titusville	44	5	----	29.95	30.00	------	79.2	------	98	26	88	64	10	71	25	----	----	----	18.97	------	18	------	e.	----	----	----	7	13	10	5.7	0.0	0.0
East Gulf States							77.8	−0.8										66	1.85	−2.8									3.9		
Atlanta	1,173	190	216	28.80	30.01	.00	75.2	−0.8	99	24	85	53	9	66	27	64	58	59	1.44	−2.3	10	6,067	nw.	39	nw.	26	11	11	8	4.8	0.0	0.0
Macon	370	78	387	29.61	30.00	−.01	77.0	−1.9	101	24	88	50	1	66	31	67	62	64	1.58	−2.5	11	3,755	e.	28	se.	29	12	8	10	4.7	0.0	0.0
Thomasville	273	49	103	29.70	29.99	−.01	77.4	−2.1	99	24	87	57	1	68	27	69	66	76	5.15	−0.3	12	4,579	e.	29	ne.	21	9	8	13	6.1	0.0	0.0
Apalachicola	36	11	51	29.94	29.98	------	77.9	------	101	23	84	62	9	72	21	72	70	76	2.68	−2.9	7	6,539	e.	28	e.	2	12	14	4	4.3	0.0	0.0
Pensacola	56	149	185	29.93	29.99	−.00	78.1	−1.2	98	23	84	62	9	72	24	70	67	73	2.53	−2.2	7	7,780	s.	32	se.	11	12	11	7	4.8	0.0	0.0
Anniston	741	9	57	29.25	30.03	+.03	74.8	−0.2	101	23	88	48	10	62	34	----	----	----	1.84	−2.3	7	2,527	se.	28	n.	26	19	8	3	2.8	0.0	0.0
Birmingham	700	11	48	29.26	30.01	+.02	77.4	−0.5	101	22	89	52	9	66	29	66	60	61	1.55	−2.9	4	3,724	n.	22	n.	30	18	10	2	3.1	0.0	0.0
Mobile	57	125	161	29.92	29.98	−.01	80.2	−0.1	100	24	89	60	9	71	28	71	67	72	0.56	−4.9	4	5,527	n.	31	se.	30	14	9	7	4.4	0.0	0.0
Montgomery	223	100	112	29.76	30.00	.00	78.8	−0.8	103	24	89	57	1	68	29	67	60	57	1.98	−1.8	8	3,793	e.	28	w.	30	17	7	6	3.8	0.0	0.0
Corinth	469	6	----	----	----	------	77.8	------	105	22	93	47	1	63	40	----	----	----	0.24	------	3	----	se.	----	----	----	----	16	14	0	----	0.0	0.0
Meridian	375	87	95	29.60	29.98	.00	77.0	−1.1	101	26	88	52	1	66	30	67	61	60	1.57	−3.0	5	2,913	e.	17	se.	30	21	4	5	2.5	0.0	0.0
Vicksburg	247	65	73	29.73	30.00	+.03	78.6	−0.4	98	26	89	55	9	68	25	68	63	62	0.03	−4.0	1	3,583	e.	15	nw.	8	25	4	1	2.1	0.0	0.0
New Orleans	53	76	84	29.93	29.98	.00	80.8	+0.2	101	27	89	66	1	72	22	72	68	70	1.27	−4.6	5	4,096	e.	19	e.	1	19	8	3	3.4	0.0	0.0
West Gulf States							79.2	−0.5										68	1.15	−2.2									3.6		
Shreveport	249	77	93	29.70	29.97	+.01	81.0	+0.3	101	25	91	60	1	71	25	69	62	57	0.76	−2.7	3	3,724	se.	21	nw.	6	21	8	1	2.7	0.0	0.0
Bentonville	1,303	11	44	28.60	29.94	.00	72.2	−1.9	93	22	83	47	8	62	29	----	----	----	4.74	------	6	3,238	s.	16	ne.	26	25	2	3	----	0.0	0.0
Fort Smith	457	79	94	29.47	29.94	.00	77.1	−0.4	101	28	88	55	1	67	29	67	62	62	2.00	−1.7	7	4,445	e.	20	nw.	24	15	10	5	3.9	0.0	0.0
Little Rock	357	136	153	29.60	29.96	.00	78.8	+1.4	99	21	89	56	9	68	25	66	58	53	0.12	−3.6	2	4,955	s.	26	n.	30	21	6	3	3.0	0.0	0.0
Austin	605	138	148	29.31	29.94	------	79.7	−1.5	100	27	89	60	1	70	28	71	68	72	1.60	−0.8	6	5,094	se.	26	s.	30	13	11	6	4.4	0.0	0.0
Brownsville	57	83	100	29.85	29.91	------	80.8	−1.6	95	27	87	67	10	74	21	75	73	83	3.01	+0.1	11	6,237	e.	23	se.	11	16	11	3	3.9	0.0	0.0
Corpus Christi	20	11	78	29.92	29.94	+.03	80.8	−0.2	98	28	86	70	10	76	20	75	73	80	0.69	−1.9	9	7,413	se.	22	se.	11	12	10	8	4.8	0.0	0.0
Dallas	512	220	227	29.41	29.94	------	80.4	------	102	28	90	58	1	71	25	----	----	----	0.30	−3.6	4	7,618	se.	32	nw.	5	23	6	1	1.9	0.0	0.0
Fort Worth	670	106	114	29.22	29.92	.00	80.2	+0.3	103	28	91	58	1	70	30	68	62	58	1.87	−1.5	4	6,734	s.	23	nw.	5	13	9	8	4.5	0.0	0.0
Galveston	54	106	114	29.93	29.99	+.04	80.6	−0.1	97	27	85	72	9	76	22	73	70	76	0.01	−4.4	1	6,996	se.	22	se.	3	17	9	4	3.6	0.0	0.0
Groesbeck	461	11	56	29.47	29.94	------	78.8	------	102	27	89	56	1	68	32	----	----	----	1.27	−1.5	4	6,101	s.	23	ne.	16	17	10	3	3.4	0.0	0.0
Houston	138	292	314	29.83	29.98	------	80.3	−1.1	100	28	90	62	1	71	27	----	----	----	0.46	−4.1	3	7,146	se.	25	se.	3	21	6	3	3.0	0.0	0.0
Palestine	510	64	72	29.44	29.96	+.02	79.2	+0.2	100	27	90	56	1	69	26	69	65	66	0.52	−3.1	1	4,234	s.	15	n.	16	14	12	4	4.0	0.0	0.0
Port Arthur	34	58	66	29.93	29.97	------	81.6	------	102	27	89	64	1	74	26	73	70	76	0.23	−4.6	3	4,342	se.	20	e.	9	23	4	3	2.4	0.0	0.0
San Antonio	693	119	132	29.22	29.93	+.03	79.6	−1.4	98	27	88	60	1	71	25	70	66	68	4.03	+1.6	7	4,597	se.	20	se.	21	8	14	8	5.3	0.0	0.0
Taylor	571	55	63	29.37	29.97	+.05	79.6	−0.4	100	27	90	58	1	69	30	----	----	----	0.35	−1.7	5	5,510	se.	23	sw.	30	17	9	4	3.6	0.0	0.0

TABLE 1.—*Climatological data for weather Bureau stations, June, 1930*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max., K2 mean min., K2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with .01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
																													0–10	In.	In.
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	K	In.	In.		Miles							4.2		
Ohio Valley and Tennessee							72.9	+0.1										58	2.04	−1.9											
Chattanooga	762	190	215	29.20	29.99	−0.01	74.8	−0.6	98	25	86	50	1	64	32	64	57	57	3.27	−0.9	10	4,420	se.	39	n.	23	14	14	2	3.9	0.0	0.0
Knoxville	995	102	111	28.97	30.00	.00	74.5	+0.5	96	23	86	48	1	63	35	64	57	60	2.60	−1.5	7	2,018	sw.	23	s.	24	16	11	3	3.8	0.0	0.0
Memphis	399	76	97	29.55	29.97	.00	78.9	+1.3	100	23	86	49	1	64	32	64	57	57	1.59	−2.4	4	4,070	n.	31	nw.	5	18	10	2	3.0	0.0	0.0
Nashville	546	168	191	29.44	30.01	+.02	74.8	−0.8	98	22	88	54	8	69	25	66	58	51	0.19	−3.4	4	5,143	s.	40	w.	24	17	10	3	3.1	0.0	0.0
Lexington	989	193	230	28.97	30.01	+.01	72.8	+0.6	97	23	86	49	1	64	32	64	57	57	1.89	−2.2	5	7,206	sw.	37	nw.	24	19	9	2	2.7	0.0	0.0
Louisville	525	188	234	29.42	30.00	+.02	73.7	−1.0	97	23	83	47	8	63	26				1.89	−2.2	5	7,206	sw.	35	nw.	24	13	13	4	3.6	0.0	0.0
Evansville	431	76	116	29.52	29.98	+.01	75.4	+0.3	98	22	85	49	8	64	27	64	57	58	1.77	−2.0	9	5,483	s.	47	sw.	25	10	14	6	4.7	0.0	0.0
Indianapolis	822	194	230	29.09	29.96	−.01	71.6	0.0	96	23	81	48	8	62	29	61	54	56	1.55	−2.1	10	6,542	sw.	33	w.	24	12	13	5	4.8	0.0	0.0
Royal Center	736	11	55	29.18	29.96	.....	68.3	.....	98	23	80	42	8	56	35	.....	.....	.....	2.57	−1.0	9	5,795	s.	34	s.	30	11	14	5	5.2	0.0	0.0
Terre Haute	575	96	129	29.35	29.96	.....	72.4	.....	98	23	83	48	8	62	29	62	56	59	1.97	−2.0	9	5,622	s.	23	sw.	6	15	11	4	3.9	0.0	0.0
Cincinnati	627	11	51	29.31	29.98	−.01	72.7	+1.5	98	23	85	46	8	61	36	61	54	58	0.98	−2.7	4	3,988	sw.	51	nw.	24	10	17	3	4.5	0.0	0.0
Columbus	822	179	222	29.12	29.98	−.01	72.0	+1.1	95	29	82	47	8	62	35	61	55	58	1.25	−2.1	10	5,838	s.	33	sw.	6	12	16	2	4.4	0.0	0.0
Dayton	899	137	173	29.03	29.96	.....	71.8	+0.4	96	23	82	47	8	61	34	62	55	58	2.38	−1.4	9	5,176	sw.	33	sw.	24	10	10	10	5.3	0.0	0.0
Elkins	1,947	59	67	28.01	30.01	+.01	65.1	−1.8	89	30	78	32	1	52	46	59	54	56	3.80	−1.3	8	2,777	w.	34	W.	24	11	9	10	5.2	0.0	0.0
Parkersburg	637	77	82	29.36	30.01	+.01	71.4	+1.0	96	24	85	42	1	60	38	61	54	56	1.17	−2.8	5	3,413	se.	27	nw.	6	11	12	7	4.7	0.0	0.0
Pittsburgh	842	353	410	29.09	29.98	−.01	69.9	−0.8	90	30	80	44	1	60	32	61	55	62	3.41	−0.4	8	6,443	sw.	29	nw.	21	11	12	7	4.7		
																														5.1		
							69.0	+2.3										67	3.89	+0.5												
Lower Lake Region																																
Buffalo	767	247	280	29.11	29.92	−.05	65.7	+1.3	84	30	72	47	8	59	23	61	58	77	3.31	+0.5	11	10,214	sw.	60	w.	26	15	4	11	4.8	0.0	0.0
Canton	448	10	61	29.42	29.88	.....	67.6	+1.8	89	30	77	35	2	58	43	.....	.....	.....	4.39	+1.1	14	6,046	sw.	38	w.	29	30	8	10	5.9	0.0	0.0
Ithaca	836	5	100	29.05	29.94	.....	67.2	+1.0	91	5	79	39	1	56	38	61	57	71	6.85	+3.3	12	5,578	nw.	38	se.	30	10	10	10	5.7	0.0	0.0
Oswego	335	76	91	29.55	29.92	−.05	66.6	+1.8	92	30	76	48	2	58	33	60	55	69	4.20	+1.0	12	5,202	s.	27	w.	10	6	10	14	6.4	0.0	0.0
Rochester	523	86	102	29.38	29.93	−.04	69.2	+3.1	94	30	79	48	1	60	31	61	56	67	4.67	+1.1	11	5,269	sw.	27	s.	30	12	9	9	4.8	0.0	0.0
Syracuse	596	65	79	29.30	29.93	−.04	71.0	+4.1	93	30	80	51	9	62	31	.....	.....	.....	5.98	+2.1	12	4,556	s.	25	se.	10	14	6	10	5.0	0.0	0.0
Erie	714	130	166	29.19	29.94	−.04	69.0	+2.8	92	30	77	49	8	61	31	63	59	73	4.58	+1.2	7	8,690	s.	37	sw.	16	19	5	6	3.8	0.0	0.0
Cleveland	762	267	337	29.14	29.94	−.04	70.2	+3.1	90	14	79	46	8	60	37	.....	.....	.....	1.84	−1.3	8	8,552	s.	37	sw.	24	9	10	11	5.4	0.0	0.0
Sandusky	629	5	67	29.28	29.96	−.02	71.0	+2.2	91	5	82	44	8	62	31	61	55	59	2.94	−0.6	7	5,224	sw.	24	sw.	5	6	16	8	5.5	0.0	0.0
Toledo	628	208	243	29.27	29.95	−.02	70.4	+1.7	90	29	80	50	7	61	35	61	55	59	1.76	−1.6	11	8,648	sw.	45	w.	6	16	10	4	4.0	0.0	0.0
Fort Wayne	856	113	124	29.05	29.96	.....	69.7	+1.2	95	23	80	46	7	59	33	60	55	62	4.06	+0.5	12	5,762	s.	26	s	27	11	13	6	4.9	0.0	0.0
Detroit	730	218	258	29.16	29.94	−.03	70.5	+3.1	89	29	80	47	7	61	31	61	55	62	2.70	−0.9	10	5,957	w.	32	w.	5	13	10	7	4.7	0.0	0.0
																														5.5		
							64.7	+2.3										70	3.19	0.0												
Upper Lake Region																																
Alpena	609	13	92	29.22	29.89	−.07	63.5	+3.1	89	14	73	43	7	54	35	57	53	72	6.05	+2.8	13	6,789	nw.	33	se.	23	9	8	13	5.8	0.0	0.0
Escanaba	612	54	60	29.20	29.86	−.08	61.8	+1.1	82	24	70	44	7	54	25	56	52	72	1.79	−1.4	10	6,900	s.	32	n.	6	10	10	10	5.2	0.0	0.0
Grand Haven	632	54	89	29.22	29.89	−.07	63.3	−0.4	85	23	72	45	7	55	29	57	52	70	1.74	−1.2	9	7,835	s.	29	nw.	29	7	11	12	6.0	0.0	0.0
Grand Rapids	707	70	87	29.17	29.92	−.05	68.7	+0.9	94	23	80	47	7	58	30	59	53	60	2.66	−0.8	9	8,192	sw.	44	sw.	14	7	13	10	5.6	0.0	0.0
Houghton	668	64	99	29.13	29.84	−.10	62.6	+2.6	87	1	73	40	7	52	30	.....	.....	.....	3.42	+0.5	12	6,028	w.	28	w.	15	10	9	11	5.4	0.0	0.0
Lansing	878	6	49	28.99	29.91	.....	66.6	+0.2	88	23	78	45	7	55	32	61	58	74	2.79	−0.7	13	2,579	sw.	21	nw.	29	10	15	5	4.7	0.0	0.0
Ludington	637	60	66	29.21	29.90	.....	61.0	+0.5	83	23	69	43	6	53	24	56	53	78	2.29	−0.6	14	6,675	w.	43	w.	23	11	16	3	4.4	0.0	0.0
Marquette	734	77	111	29.06	29.86	−.08	62.6	+3.7	89	22	73	40	6	52	35	56	52	72	5.62	+2.4	14	6,774	s.	33	e.	12	7	7	16	6.4	0.0	0.0
Port Huron	638	70	120	29.23	29.92	−.05	67.2	+3.0	88	5	77	46	7	58	29	60	56	71	2.60	−0.1	9	6,774	s.	30	w.	16	12	10	8	5.3	0.0	0.0
Sault Ste. Marie	614	11	52	29.18	29.87	−.09	60.8	+2.2	84	22	71	41	9	51	34	55	51	73	4.84	+1.9	15	4,705	nw.	27	nw.	27	12	5	13	5.3	0.0	0.0
Chicago	673	7	131	29.22	29.94	−.09	60.8	+2.2	84	23	79	47	6	61	30	60	54	63	2.49	−0.8	9	6,497	sw.	37	sw.	30	8	13	9	5.5	0.0	0.0
Green Bay	617	109	141	29.21	29.86	−.09	70.1	+2.8	97	23	77	45	6	58	29	60	55	68	3.02	−0.7	12	6,927	s.	37	nw.	16	7	7	16	6.4	0.0	0.0
Milwaukee	681	125	221	29.18	29.90	−.05	67.4	+2.5	92	23	77	46	7	58	33	60	55	66	1.60	−1.8	10	8,440	sw.	35	n.	29	8	12	10	5.6	0.0	0.0
Duluth	1,133	5	47	28.66	29.86	−.06	68.0	+4.1	94	23	77	46	7	58	33	60	55	68	3.02	−0.7	12	6,927	s.	37	nw.	16	7	7	16	6.4	0.0	0.0
							62.8	+5.6	84	20	73	43	5	52	35	56	52	73	3.74	−0.2	16	6,807	nw.	33	sw.	14	11	10	9	5.1	0.0	0.0
																														5.3		
							64.0	+0.9										64	2.44	−1.4												
North Dakota																																
Moorhead	940	50	58	28.84	29.84	−.06	65.0	+0.6	91	21	76	39	6	54	33	57	51	64	2.70	−1.4	11	5,583	s.	31	sw.	1	8	10	12	5.9	0.0	0.0
Bismarck	1,674	8	57	28.08	29.83	−.04	64.5	+0.8	86	26	75	43	6	54	33	56	50	64	2.19	−1.2	9	7,574	nw.	54	sw.	1	14	11	5	4.4	0.0	0.0
Devils Lake	1,478	11	44	28.27	29.82	−.06	63.3	+1.4	85	21	74	38	6	52	33	56	51	67	3.65	+0.1	14	6,485	s.	34	w.	1	6	11	13	6.0	0.0	0.0
Ellendale	1,457	10	56	28.30	29.84	.....	63.3	.....	90	21	76	37	6	51	37	.....	.....	.....	1.35	−3.2	10	9,766	nw.	45	sw.	1	8	10	12	5.8	0.0	0.0
Grand Forks	833	12	67	.....	.....	.....	64.8	.....	89	21	76	36	6	53	37	58	.....	.....	2.60	.....	10	.....	nw.	42	sw.	1	17	11	2	.....	0.0	0.0
Williston	1,878	41	48	27.88	29.82	−.04	63.4	+0.7	88	27	74	42	3	52	37	54	48	63	2.32	−1.1	12	5,869	w.	37	nw.	29	13	10	7	4.3		
																														5.1		
							70.8	+0.3										65	5.67	+1.6												
Upper Mississippi Valley																																
Minneapolis	918	102	208	28.88	29.84	.....	68.6	+1.1	91	21	78	50	18	59	32	.....	.....	.....	6.68	+2.5	17	6,816	w.	33	se.	13	11	7	12	5.6	0.0	0.0
St. Paul	837	236	261	28.97	29.86	−.06	67.6	+0.5	88	21	77	50	7	58	30	.....	.....	.....	4.44	+0.3	15	7,401	sw.	41	sw.	1	12	10	8	4.9	0.0	0.0
La Crosse	714	11	48	29.11	29.87	−.06	68.9	+0.6	93	23	79	44	7	59	32	61	58	74	6.89	+2.8	15	2,805	s.	21	nw.	29	7	13	10	5.9	0.0	0.0
Madison	974	70	78	28.88	29.90	−.04	67.8	+0.6	90	23	76	48	7	59	24	60	56	70	6.60	+2.8	15	5,229	nw.	24	sw.	12	8	13	9	5.4	0.0	0.0
Wausau	1,247	4	62	28.57	29.87	.....	67.0	.....	89	23	78	46	8	56	33	.....	.....	.....	9.61	+5.6	15	4,059	s.	30	sw.	23	10	13	7	4.8	0.0	0.0
Charles City	1,015	10	51	28.84	29.90	−.01	67.8	+1.3	91	23	78	44	8	57	30	61	57	72	9.30	+4.7	11	3,979	nw.	27	nw.	22	11	10	9	5.3	0.0	0.0
Davenport	606	71	79	29.27	29.92	−.02	71.0	+0.5	96	23	81	50	8	61	27	62	57	65	9.14	+5.0	15	6,355	nw.	36	s.	12	10	12	8	5.6	0.0	0.0
Des Moines	861	5	99	29.01	29.90	−.02	70.2	−0.4	95	22	80	47	8	60	28	62	57	66	3.69	−1.1	10	6,234	s.	35	s.	13	6	16	8	4.9	0.0	0.0
Dubuque	700	81	96	29.17	29.90	−.03	69.0	−0.4	94	23	79	47	8	60	28	63	57	62	5.21	+0.9	15	4,115	nw.	19	s.	19	8	12	8	5.2	0.0	0.0
Keokuk	614	64	78	29.29	29.94	.00	72.2	−0.3	97	22	82	46	8	63	28	63	57	62	4.06	+1.1	10	4,913	s.	24	w.	30	10	12	8	5.2	0.0	0.0
Cairo	358	87	93	29.60	29.97	.00	76.1	−0.2	99	22	86	54	8	66	27	66	57	64	1.59	−2.2	7	4,565	s.	39	n.	25	12	12	8	4.7	0.0	0.0
Peoria	609	11	45	29.31	29.94	.00	71.6	+0.7	99	23	83	44	8	60	32	62	57	64	2.53	−1.2	12	3,606	s.	17	sw.	23	13	10	7	4.2	0.0	0.0
Springfield, Ill	636	154	191	29.28	29.94	−.01	71.8	−0.4	97	23	82	47	8	62	29	62	56	60	2.40	−1.7	10	7,790	s.	35	s.	25	8	13	9	5.1	0.0	0.0
Hannibal	534	74	109	29.38	29.94	−.01	72.8	+0.3	99	23	83	43	8	63	33	.....	.....	.....	10.35	+6.4	7	5,560	nw.	25	se.	25	14	9	7	4.7	0.0	0.0
St. Louis	568	265	303	29.36	29.95	.00	75.1	+0.3	101	22	85	52	8	66	27	63	56	55	2.63	−1.2	8	7,760	s.	41	sw.	30	14	11	5	4.2	0.0	0.0
																														3.9		
							70.5	−0.3										62	3.35	−0.9												
Missouri Valley																																
Columbia, Mo	784	6	84	29.13	29.94	−.01	72.0	−0.8	98	22	82	45	8	62	32	.....	.....	.....	3.10	−1.7	9	4,546	s.	25	sw.	29	12	12	6	4.8	0.0	0.0
Kansas City	963	161	181	28.91	29.92	.00	73.4	−0.2	97	21	83	52	8	64	25	63	58	62	3.78	−1.2	9	5,999	s.	34	sw.	29	19	7	4	3.5	0.0	0.0
St. Joseph	967	11	49	28.90	29.91	.....	72.0	.....	97	22	82	47	8	62	25	63	58	66	5.32	+0.4	10	5,299	se.	32	nw.	29	17	8	5	3.7	0.0	0.0
Springfield, Mo	1,324	98	104	28.60	29.98	+.03	71.4	−1.1	92	25	80	50	8	63	25	63	58	63	4.31	−0.4	5	6,470	s.	35	nw.	25	22	5	3	2.1	0.0	0.0
Iola	984	11	50	28.90	29.92	−.01	72.8	−1.3	94	22	83	48	8	62	28	.....	.....	.....	6.03	+0.6	9	3,897	s.	17	n.	4	15	10	5	4.1	0.0	0.0
Topeka	987	92	107	.....	.....	.....	72.4	−1.0	97	22	82	50	8	62	28	.....	.....	.....	4.73	+0.1	9	6,596	sw.	38	nw.	4	14	10	6	4.0	0.0	0.0
Lincoln	1,189	11	81	28.65	29.89	−.01	71.2	−0.2	101	21	83	45	8	59	36	63	59	68	2.95	−1.4	8	6,311	s.	27	s.	13	11	12	7	4.7	0.0	0.0
Omaha	1,105	115	122	28.74	29.90	−.01	71.6	0.0	100	22	82	50	8	61	28	61	55	59	1.56	−3.0	5	4,869	s.	33	n.	25	17	10	3	3.6	0.0	0.0
Valentine	2,598	47	54	27.22	29.89	+.03	66.6	−0.3	102	28	80	39	6	53	40	56	49	60	1.34	−1.5	9	6,180	w.	40	sw.	1	17	9	4	3.4	0.0	0.0
Sioux City	1,135	94	164	28.71	29.89	−.01	69.7	−0.2	99	22	81	45	7	59	32	61	55	61	5.67	+1.7	9	7,314	se.	42	sw.	3	11	15	11	4.7	0.0	0.0
Huron	1,306	59	74	28.51	29.88	.00	66.6	+0.4	98	28	79	41	7	54	39	58	52	61	1.71	−2.1	8	6,411	se.	32	nw.	29	15	11	4	4.0	0.0	0.0
Pierre	1,572	70	75	28.21	29.85	−.02	69.2	+0.7	100	21	81	43	7	57	34	58	50	57	1.34	−1.6	6	6,798	nw.	54	w.	24	10	17	3	4.4	0.0	0.0
Yankton	1,233	49	57	28.58	29.88	−.01	68.9	0.0	98	22	81	47	7	57	41	.....	.....	.....	1.73	−2.0	8	4,879	s.	34	nw.	24	15	13	2	3.7	0.0	0.0

TABLE 1.—*Climatological data for Weather Bureau stations, June, 1930*

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max., K mean min., K2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with .01, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	K	In.	In.		Miles								0–10	In.	In.
Northern Slope							62.0	+0.5										52	1.55	−0.8										3.9		
Billings	3,140	5					64.5		96	11	84	31	4	46	53				0.79		8		nw.				17	4	9		0.0	0.0
Havre	2,505	11	44	27.26	29.85	0.00	63.6	+1.6	97	16	77	42	5	50	47	51	40	50	1.65	−1.2	11	4,986	sw.	30	sw.	20	12	14	4	4.7	0.0	0.0
Helena	4,124	89	113	25.76	29.88	.00	60.8	+1.6	94	16	74	39	4	48	44	47	34	42	0.54	−1.8	5	6,654	sw.	42	sw.	13	10	7	13	5.4	0.0	0.0
Kalispell	2,973	48	56	26.90	29.92	+.03	57.5	−0.2	88	10	70	37	3	46	40	47	39	57	2.52	+0.5	7	4,251	w.	26	w.	17	9	15	6	5.1	0.0	0.0
Miles City	2,371	48	55	27.37	29.88	+.03	66.0	0.0	97	17	79	43	4	54	36	53	43	50	1.75	−0.9	6	4,736	nw.	34	nw.	17	14	14	2	3.9	0.0	0.0
Rapid City	3,259	50	58	26.55	29.90	+.05	64.8	+0.6	94	28	78	38	6	52	35	53	43	49	2.16	−1.2	11	5,475	w.	32	nw.	24	15	12	3	3.9	0.0	0.0
Cheyenne	6,088	84	101	24.02	29.85	+.01	61.2	+0.8	89	27	76	40	15	47	40	50	41	55	0.34	−1.3	3	7,000	w.	46	w.	4	20	7	3	3.1	0.0	0.0
Lander	5,372	60	68	24.62	29.86	+.01	61.6	+1.1	89	27	77	36	2	46	44	47	34	43	0.12	−1.0	5	3,835	w.	34	nw.	23	24	6	0	2.0	0.0	0.0
Sheridan	3,790	10	47	26.04	29.88		60.9		94	27	78	33	14	44	50	50	41	56	1.39	−0.6	6	3,010	nw.	24	nw.	11	22	6	2	3.0	0.0	0.0
Yellowstone Park	6,241	11	48		29.91	+.05	54.2	−1.8	83	16	68	31	5	40	43			49	1.00	−0.9	9	5,148	sw.	33	sw.	11	13	10	7		T.	0.0
North Platte	2,821	11	51	27.00	29.87	+.01	68.4	+0.9	96	21	81	43	6	56	37	59	54	66	4.06	+0.8	16	4,102	se.	29	sw.	22	18	4	8	3.7	0.0	0.0
Middle Slope							73.0	+1.2										56	3.38	+0.1										3.6		
Denver	5,292	106	113	24.72	29.85	+.01	69.2	+2.9	96	28	83	46	5	56	36	51	37	39	0.17	−1.2	3	4,695	s.	29	nw.	21	22	6	2	2.5	0.0	0.0
Pueblo	4,685	80	86	25.22	29.79	−.04	71.2	+2.2	101	27	87	46	2	55	43	54	41	43	1.89	+0.5	4	4,519	e.	34	n.	30	22	7	1	2.5	0.0	0.0
Concordia	1,392	50	58	28.47	29.91	+.01	71.7	−1.3	100	21	82	47	8	61	33	63	58	65	3.58	−0.8	9	5,180	s.	24	s.	13	15	7	8	4.1	0.0	0.0
Dodge City	2,509	11	51	27.34	29.88	+.01	74.7	+2.2	105	28	87	50	6	62	38	62	55	60	1.27	−2.0	9	6,615	se.	30	se.	2	23	4	3	2.8	0.0	0.0
Wichita	1,358	139	158	28.48	29.88	−.03	74.4	0.0	101	25	84	53	6	64	27	64	59	63	2.36	−2.0	5	8,973	s.	38	s.	29	13	13	4	3.9	0.0	0.0
Broken Arrow	765	11	56	29.13	29.95		73.8		92	22	83	52	7	64	25				5.60	+1.4	9	8,343	s.	30	nw.	5	14	10	6	4.4	0.0	0.0
Oklahoma City	1,214	10	47	28.65	29.90	−.01	77.1	+1.1	99	25	87	58	6	67	26	67	63	66	8.76	+5.1	8	6,660	s.	22	n.	27	13	9	8	4.8	0.0	0.0
Southern Slope							78.0	+0.1										58	2.53	0.0										4.0		
Abilene	1,738	10	52	28.12	29.88	.00	79.6	+0.4	101	28	90	60	7	69	30	67	60	58	1.73	−1.3	5	7,352	s.	26	n.	5	13	10	7	4.5	0.0	0.0
Amarillo	3,676	10	49	26.23	29.87	+.02	75.6	+2.8	104	29	88	52	8	63	34	61	53	55	4.47	+1.6	9	6,707	s.	30	w.	4	16	13	1	3.1	0.0	0.0
Del Rio	944	64	71	28.91	29.87	+.02	80.2	−3.2	97	28	88	63	11	72	24	71	67	70	2.19	−0.4	8	6,991	se.	22	se.	3	11	11	8	5.2	0.0	0.0
Roswell	3,566	75	85	26.30	29.81	+.01	76.6	+0.3	103	28	91	54	1	63	40	61	51	51	1.72	0.0	4	5,827	s.	34	n.	6	18	10	2	3.1	0.0	0.0
Southern Plateau							76.1	+1.9										33	0.21	−0.1										1.8		
El Paso	3,778	152	175	26.10	29.76	+.01	81.6	+2.0	105	30	94	54	10	69	35	59	42	31	0.53	0.0	4	5,846	e.	36	nw.	10	20	10	0	2.6	0.0	0.0
Santa Fe	7,013	38	53	23.28	29.77	−.04	67.1	+2.3	90	13	81	34	1	53	38	49	34	37	0.37	−0.7	3	4,157	se.	23	sw.	22	18	11	1	2.9	0.0	0.0
Flagstaff	6,907	10	59	23.38	29.79	+.01	61.2	+1.9	90	13	80	27	1	42	45	44		37	0.18		2	5,376	n.	28	ne.	16	17	11	2		0.0	0.0
Phoenix	1,108	10	107	28.60	29.71	−.03	86.8	+2.3	110	30	102	57	1	71	43	61	41	25	0.16	+0.1	3	3,675	w.	36	e.	16	26	3	1	1.3	0.0	0.0
Yuma	141	9	54	29.58	29.72	−.02	84.3	−0.4	111	7	102	55	1	66	46	63	48	37	T.	0.0	0	3,103	sw.	18	s.	12	30	0	0	0.4	0.0	0.0
Independence	3,957	6	27	25.87	29.81	+.03	75.5	+3.2	102	11	92	48	1	59	42	52			0.00	−0.1	0		nw.				25	5	0		0.0	0.0
Middle Plateau							67.2	+2.0										32	0.28	−0.2										1.9		
Reno	4,532	74	81	25.43	29.85	−.01	65.8	+4.8	97	15	84	38	2	48	47	48	34	39	T.	−0.3	0	4,701	w.	29	w.	21	26	4	0	1.3	0.0	0.0
Tonopah	6,090	12	20				68.2		91	15	80	40	2	56	30	48	29	26	0.12		1		nw.									
Winnemucca	4,344	18	56	25.58	29.91	+.03	64.2	+1.4	95	15	82	36	3	47	47	47	32	38	0.06	−0.7	2	4,254	sw.	28	s.	19	25	4	1	1.5	0.0	0.0
Modena	5,473	10	43	24.58	29.81	−.01	65.0	+1.7	93	11	83	33	1	47	46	46	26	29	0.71	+0.4	2	6,962	sw.	37	w.	17	18	10	2	2.3	0.0	0.0
Salt Lake City	4,360	163	203	25.58	29.86	+.01	68.9	+1.5	96	16	81	47	1	57	38	50	33	31	0.32	−0.5	3	4,965	nw.	32	nw.	2	21	7	2	1.9	0.0	0.0
Grand Junction	4,602	60	68	25.32	29.82	−.01	72.0	+0.6	98	27	87	46	1	57	39	51	31	29	0.31	−0.1	3	3,815	se.	22	s.	2	21	6	3	2.3	0.0	0.0
Northern Plateau							63.0	−0.7										46	0.80	−0.4										3.9		
Baker	3,471	48	53	26.45	30.01	+.06	56.3	−2.3	88	30	71	33	3	41	47	46	38	56	0.86	−0.5	6	3,460	se.	18	n.	11	14	9	7	4.2	0.0	0.0
Boise	2,739	78	86	27.12	29.95	+.04	64.4	−0.9	94	16	79	36	3	50	43	50	36	43	0.20	−0.7	4	3,649	nw.	20	nw.	23	18	8	4	3.4	0.0	0.0
Lewiston	757	40	48	29.16	29.96	+.02	66.3	−0.3	94	15	79	47	15	53	47				0.90	−0.5	9	3,036	e.	25	nw.	11	12	14	4	4.1	0.0	0.0
Pocatello	4,477	60	68	25.45	29.89	+.02	63.8	+1.6	94	16	77	38	5	50	44	48	32	36	0.71	−0.4	6	5,616	sw.	33	sw.	13	19	7	4	3.1	0.0	0.0
Spokane	1,929	101	110	27.93	29.96	+.02	61.2	−1.6	88	15	74	42	3	49	40	50	40	53	1.52	+0.2	7	4,295	sw.	25	nw.	12	9	16	5	5.0	0.0	0.0
Walla Walla	991	57	65	28.91	29.97	+.01	65.8	−0.7	95	6	78	46	14	53	44	52	40	44	0.58	−0.5	5	3,068	s.	17	w.	12	17	9	4	3.7	0.0	0.0
North Pacific Coast Region							59.0	−0.6										67	1.11	−0.3										5.5		
North Head	211	11	56	29.87	30.10	+.11	54.6	−0.2	70	15	58	47	3	51	20	51	49	84	1.34	−0.9	11	9,120	n.	37	n.	16	7	9	14	6.2	0.0	0.0
Port Angeles	29	8	53		30.09		54.4		79	19	62	39	17	47	34				0.62	−0.3	6	4,729	w.	32	w.	15	6	10	14		0.0	0.0
Seattle	125	215	250	29.91	30.04	+.04	58.8	−0.2	86	15	67	45	3	51	32	52	47	68	1.71	+0.4	8	5,385	s.	35	sw.	15	5	14	11	6.2	0.0	0.0
Tacoma	194	172	201	29.86	30.06	+.03	59.3	+0.6	87	15	68	44	3	50	36				1.09	−0.4	8	5,554	n.	27	sw.	15	4	18	8	6.1	0.0	0.0
Tatoosh Island	86	9	53	29.97	30.06	+.04	52.7	−0.3	65	19	56	46	3	49	17	51	50	92	3.54	+0.3	17	6,804	s.	35	s.	20	6	3	21	7.4	0.0	0.0
Yakima	1,076	58	67	28.84	29.98		63.9	−2.5	90	9	77	40	3	51	39	50	38	45	0.44	−0.2	4	4,123	nw.	24	sw.	12	14	6	10	4.2	0.0	0.0
Medford	1,329	29	58	28.58	29.97		64.2		99	15	81	39	13	48	49	52	42	56	0.12	−0.6	3		nw.	25	nw.	6	18	7	5	3.0	0.0	0.0
Portland, Oreg	153	68	106	29.90	30.05	+.01	62.2	−0.2	94	15	72	45	18	52	37	54	47	63	0.69	−0.8	5	3,743	nw.	20	sw.	15	5	9	16	6.7	0.0	0.0
Roseburg	510	75	99	29.50	30.05	+.02	61.2	−1.3	95	15	74	40	2	48	46	52	44	62	0.47	−0.6	4	3,169	n.	24	n.	17	13	13	4	4.0	0.0	0.0
Middle Pacific Coast Region							65.5	+1.1										63	0.03	−0.3										2.3		
Eureka	62	73	89	30.01	30.08	+.03	54.2	−0.1	63	3	59	44	13	49	15	51	48	83	0.13	−0.6	3	5,433	n.	26	nw.	11	12	10	8	5.0	0.0	0.0
Red Bluff	330	5	58	29.50	29.84	−.04	77.3	+2.5	106	14	93	54	22	62	40	58	42	35	0.00	−0.5	0	4,299	nw.	23	nw.	13	26	2	2	1.5	0.0	0.0
Sacramento	69	106	117	29.78	29.85	−.04	71.6	+2.2	104	10	88	48	26	55	47	58	49	58	T.	−0.2	0	5,309	s.	21	s.	18	28	1	1	0.7	0.0	0.0
San Francisco	155	208	243	29.75	29.92	−.04	59.9	+1.4	79	5	67	50	2	52	27	53	50	76	T.	−0.2	0	5,203	sw.	26	nw.	3	23	5	2	2.4	0.0	0.0
San Jose	141	12	110	29.78	29.93		64.6	−0.4	92	30	79	44	2	51	42				T.	−0.1	0	4,350	nw.	26	sw.	18	26	3	1	1.7	0.0	0.0
South Pacific Coast Region							69.6	+0.9										63	0.01	−0.1										3.1		
Fresno	327	89	98	29.49	29.83	−.02	76.6	+0.8	104	30	93	50	2	60	38	58	42	36	0.00	−0.1	0	5,746	nw.	21	nw.	7	29	1	0	0.4	0.0	0.0
Los Angeles	338	159	191	29.54	29.90	.00	67.6	+1.2	89	5	76	54	1	59	30	60	56	72	T.	−0.1	0	3,004	sw.	12	sw.	21	17	8	5	3.8	0.0	0.0
San Diego	87	62	70	29.80	29.90	−.02	64.6	+0.7	80	6	69	57	24	60	18	60	57	80	0.02	0.0	1	4,118	sw.	16	w.	7	13	7	10	5.2	0.0	0.0
West Indies																																
San Juan, P. R.	82	9	54	29.92	30.01		79.8	+0.1	89	14	84	72	7	75	15				2.38	−2.9	14	8,350	e.	29	e.	27	8	12	10	5.8	0.0	0.0
Panama Canal																																
Balboa Heights	118	6	97	[1] 29.72	[2] 29.82	−.01	79.4	−0.7	92	22	87	72	4	74	19			[3] 86	2.50	−5.5	13	3,641	nw.	22	s.	12	0	12	18	7.8	0.0	0.0
Cristobal	36	6	97	[1] 29.79	[2] 29.82	−.01	80.7	+0.3	90	20	87	74	20	77	16	77	75	[3] 82	9.40	−4.4	22	4,835	n.	28	n.	38	1	11	18	7.8	0.0	0.0
Alaska																																
Fairbanks	455	11	44	[1] 29.32	[1] 29.82		57.3		85	21	68	39	9	46	36				2.09		14	2,592	sw.				4	15	11	6.3	0.0	0.0
Juneau	80	11	50	[1] 29.87	[1] 29.96		52.6		82	21	60	38	12	45	33	47	42	73	3.78		17	4,361	w.	23	se.	5	7	6	17	6.6	0.0	0.0
Hawaiian Islands																																
Honolulu	38	86	100	[1] 29.99	[1] 30.03		76.2	−0.4	82	3	80	70	16	72	11	68	64	69	0.95	0.0	21	6,762	e.	24	e.	27	10	15	5	4.8	0.0	0.0

[1] Pressure not reduced to mean of 24 hours.

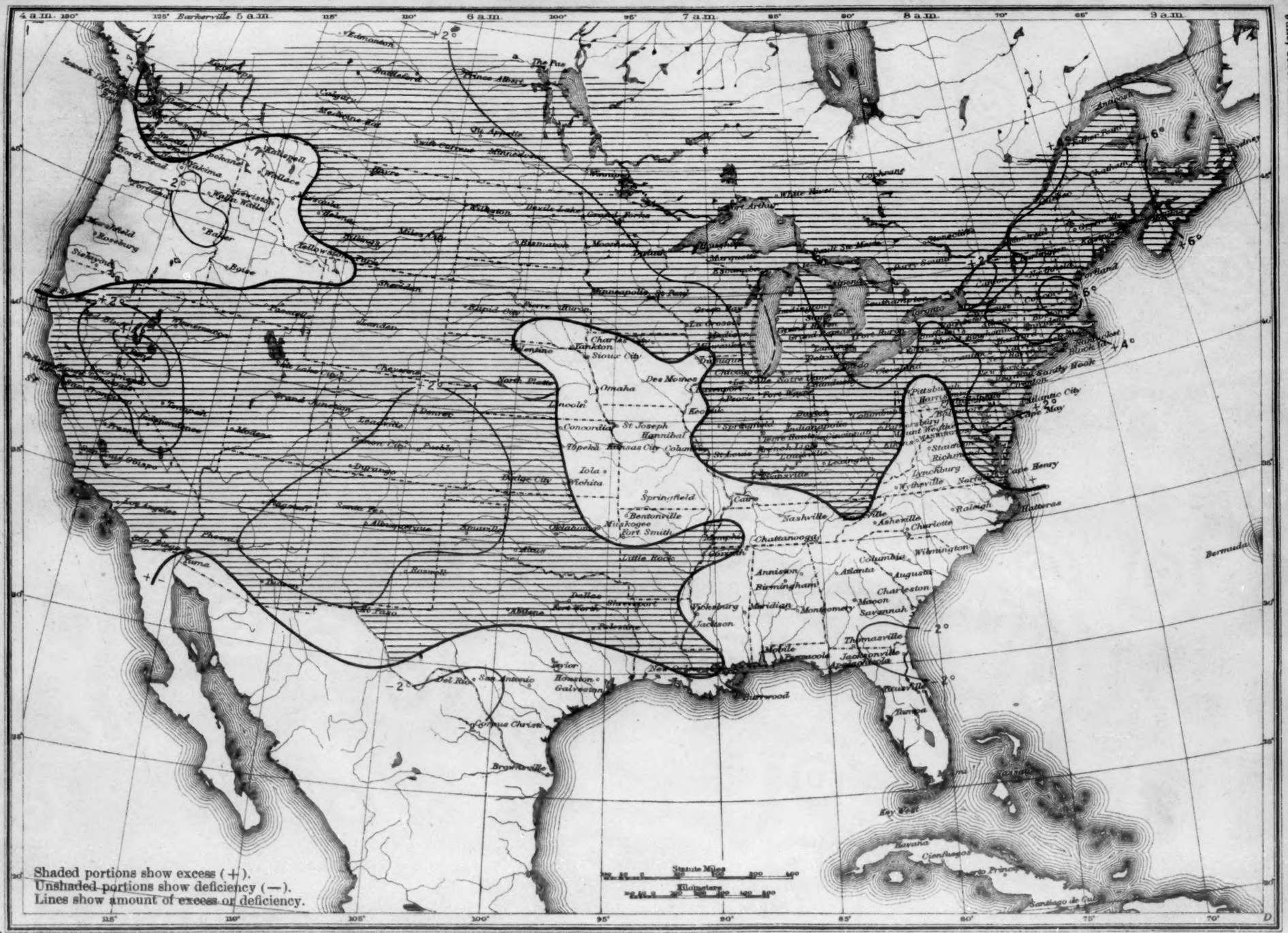
[2] Observations taken hourly.

TABLE 2.—*Data furnished by the Canadian Meteorological Service, June, 1930*

Stations	Altitude above mean sea level, Jan. 1, 1919	Pressure			Temperature of the air						Precipitation		
		Station reduced to mean of 24 hours	Sea level reduced to mean of 24 hours	Departure from normal	Mean max. + mean min. ÷ 2	Departure from normal	Mean maximum	Mean minimum	Highest	Lowest	Total	Departure from normal	Total snowfall
	Feet	*Inches*	*Inches*	*Inches*	*° F*	*° F*	*° F*	*° F*	*° F*	*° F*	*Inches*	*Inches*	*Inches*
Cape Race, N. F.	99				51.8		61.9	41.7	78	21	4.47		0.0
Sydney, C. B. I.	48	29.90	29.95	0.00	65.2	+9.8	77.2	53.3			0.88	−2.35	0.0
Halifax, N. S.	88	29.88	29.98	+.03	64.2	+6.5	75.5	52.8	92	35	2.21	−1.55	0.0
Yarmouth, N. S.	65												
Charlottetown, P. E. I.	38	29.83	29.87	−.05	67.2	+9.8	75.8	58.6	87	38	1.46	−1.21	0.0
Chatham, N. B.	28	29.79	29.82	−.07	65.9	+5.9	76.8	55.0	91	37	4.07	+0.61	0.0
Father Point, Que.	20												
Quebec, Que.	296	29.57	29.89	−.03	64.7	+3.5	73.8	55.6	87	42	4.67	+1.02	T.
Doucet, Que.	1,236				61.1		71.5	50.7	86	28	7.78		0.0
Montreal, Que.	187	29.66	29.86	−.08	69.4	+4.5	78.4	60.3	90	48	4.42	+0.89	0.0
Ottawa, Ont.	236	29.60	29.86	−.08	67.8	+2.5	78.0	57.6	89	42	4.67	+1.75	0.0
Kingston, Ont.	285												
Toronto, Ont.	379	29.50	29.89	−.08	66.9	+3.5	76.9	56.9	91	46	2.43	−0.37	0.0
Cochrane, Ont.	930				60.5		70.8	50.2	83	36	5.22		0.0
White River, Ont.	1,244	28.53	29.81	−.13	58.8	+0.1	73.0	44.7	85	29	3.55	+1.33	0.0
London, Ont.	808												
Southampton, Ont.	656												
Parry Sound, Ont.	688	29.19	29.87	−.09	64.1	+2.4	73.1	55.1	85	43	4.30	+1.88	0.0
Port Arthur, Ont.	644												
Winnipeg, Man.	760												
Minnedosa, Man.	1,690												
Le Pas, Man.	860				62.2		74.1	50.4	85	34	3.28		0.0
Qu'Appelle, Sask.	2,115	27.58	29.79	−.08	59.0	−0.9	69.4	48.6	81	33	4.55	+1.13	0.0
Moose Jaw, Sask.	1,759				62.4		75.2	49.7	87	36	2.31		0.0
Swift Current, Sask.	2,392	27.28	29.75	−.12	60.6	+0.6	74.6	46.5	92	34	4.05	+1.38	0.0
Medicine Hat, Alb.	2,144	27.53	29.75	−.10	62.8	+0.8	75.2	50.4	96	36	2.14	−0.62	0.0
Calgary, Alb.	3,428												
Banff, Alb.	4,521	25.33	29.84	.00	51.8	+0.3	63.8	39.7	78	31	2.31	−1.02	0.0
Prince Albert, Sask.	1,450	28.23	29.78	−.09	60.8	+3.1	71.2	50.3	92	33	4.08	+1.57	0.0
Battleford, Sask.	1,592	28.05	29.76	−.10	60.1	+0.6	70.6	49.6	93	36	4.11	+0.80	0.0
Edmonton, Alb.	2,150	27.52	29.76	−.08	57.5	+0.6	68.6	46.4	90	30	2.59	−0.27	0.0
Kamloops, B. C.	1,262												
Victoria, B. C.	230	29.78	30.03	+.02	56.6	+0.3	63.9	49.4	82	45	0.66	−0.54	0.0
Barkerville, B. C.	4,180												
Estevan Point, B. C.	20												
Prince Rupert, B. C.	170												
Hamilton, Ber.	151												
LATE REPORTS, MAY, 1930													
Winnipeg, Man.	760	29.09	29.92	−.04	50.4	−1.2	60.1	40.7	91	26	4.11	+1.83	0.1
Medicine Hat, Alb.	2,144	27.54	29.78	−.11	55.0	+0.9	67.6	42.4	82	31	1.33	+0.02	T.
Calgary, Alb.	3,428	26.40	29.97	+.09	47.0	−2.0	58.5	35.5	74	28	1.19	−0.58	0.0
Kamloops, B. C.	1,262	28.60	29.88	−.01	55.6	−3.5	66.3	44.9	82	33	0.60	−0.64	0.0
Estevan Point, B. C.	20				47.8		54.6	41.0	60	33	3.56		0.0
Prince Rupert, B. C.	170				46.6		53.8	39.4	68	34	4.00		0.0

Chart I. Departure (°F.) of the Mean Temperature from the Normal, June, 1930

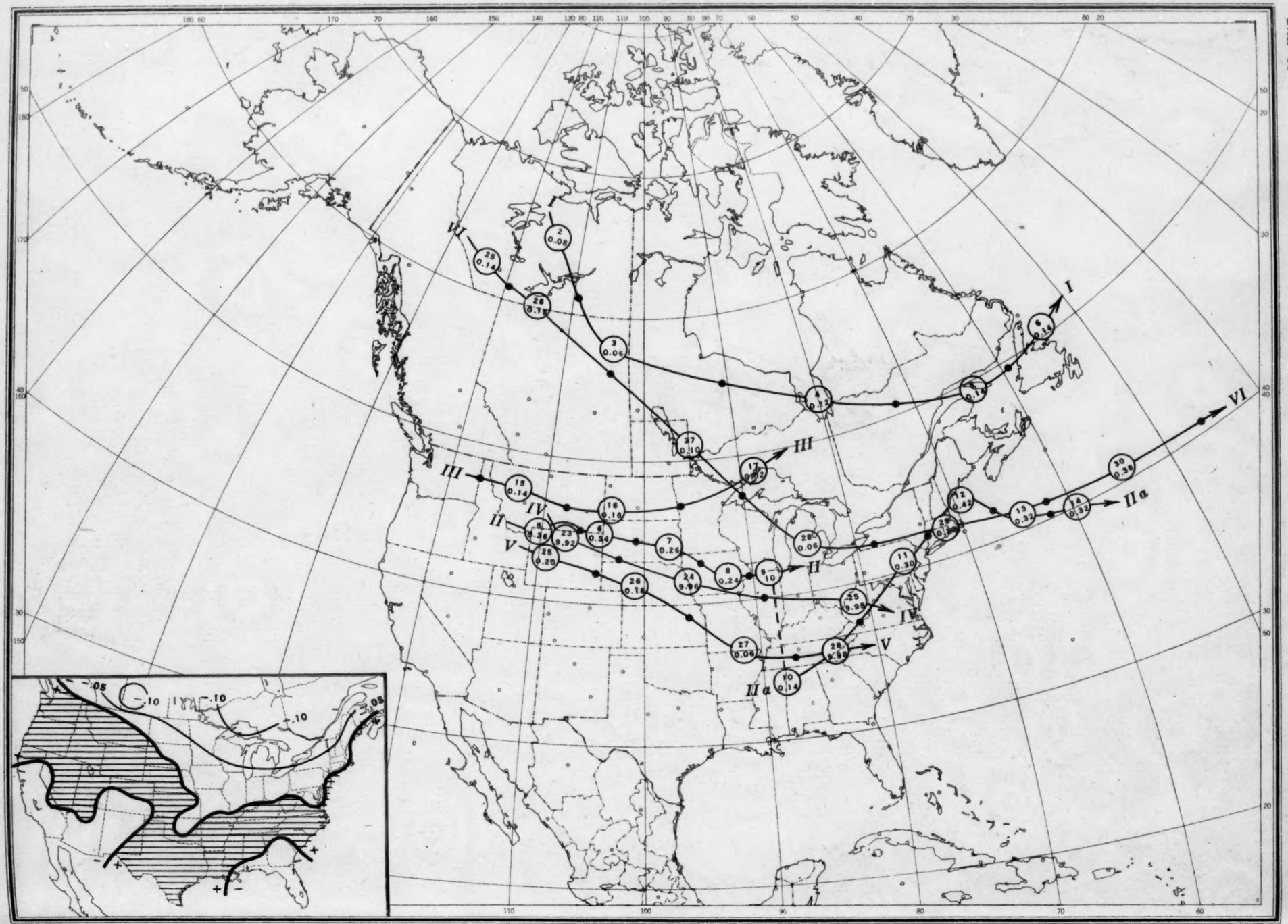
Chart I. Departure (°F.) of the Mean Temperature from the Normal, June, 1930


Shaded portions show excess (+).
Unshaded portions show deficiency (—).
Lines show amount of excess or deficiency.
Statute Miles
Kilometers

UNIV. OF MICH.

Chart II. Tracks of Centers of Anticyclones, June, 1930. (Inset) Departure of Monthly Mean Pressure from Normal

(Plotted by Welby R. Stevens)



Circle indicates position of anticyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 8 p. m. (75th meridian time).

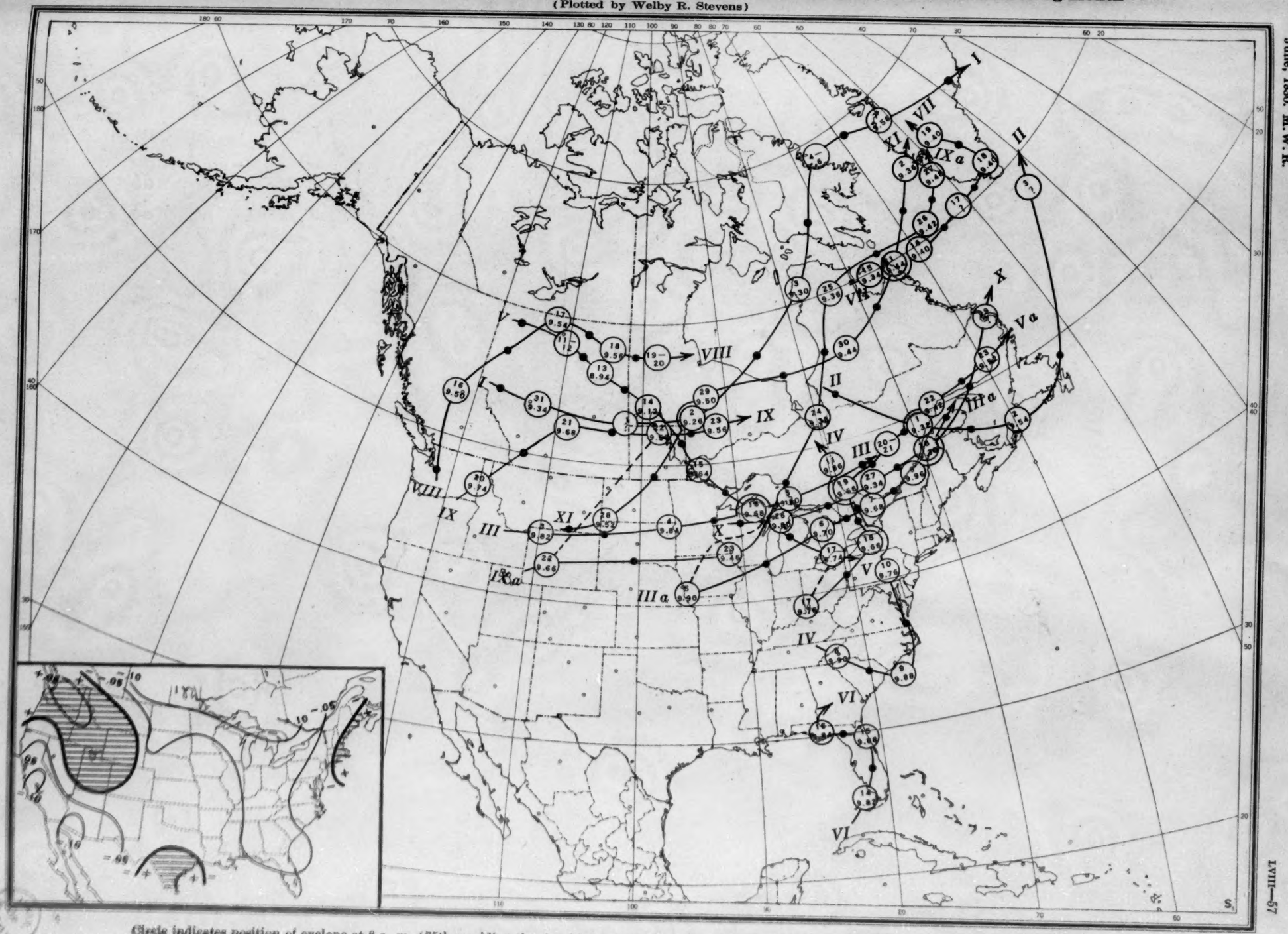
Chart III. Tracks of Centers of Cyclones, June, 1930. (Inset) Change in Mean Pressure from Preceding Month

(Plotted by Welby R. Stevens)

Circle indicates position of anticyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 8 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, June, 1930. (Inset) **Change in Mean Pressure from Preceding Month**

(Plotted by Welby R. Stevens)



Circle indicates position of cyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 8 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky between Sunrise and Sunset, June, 1930

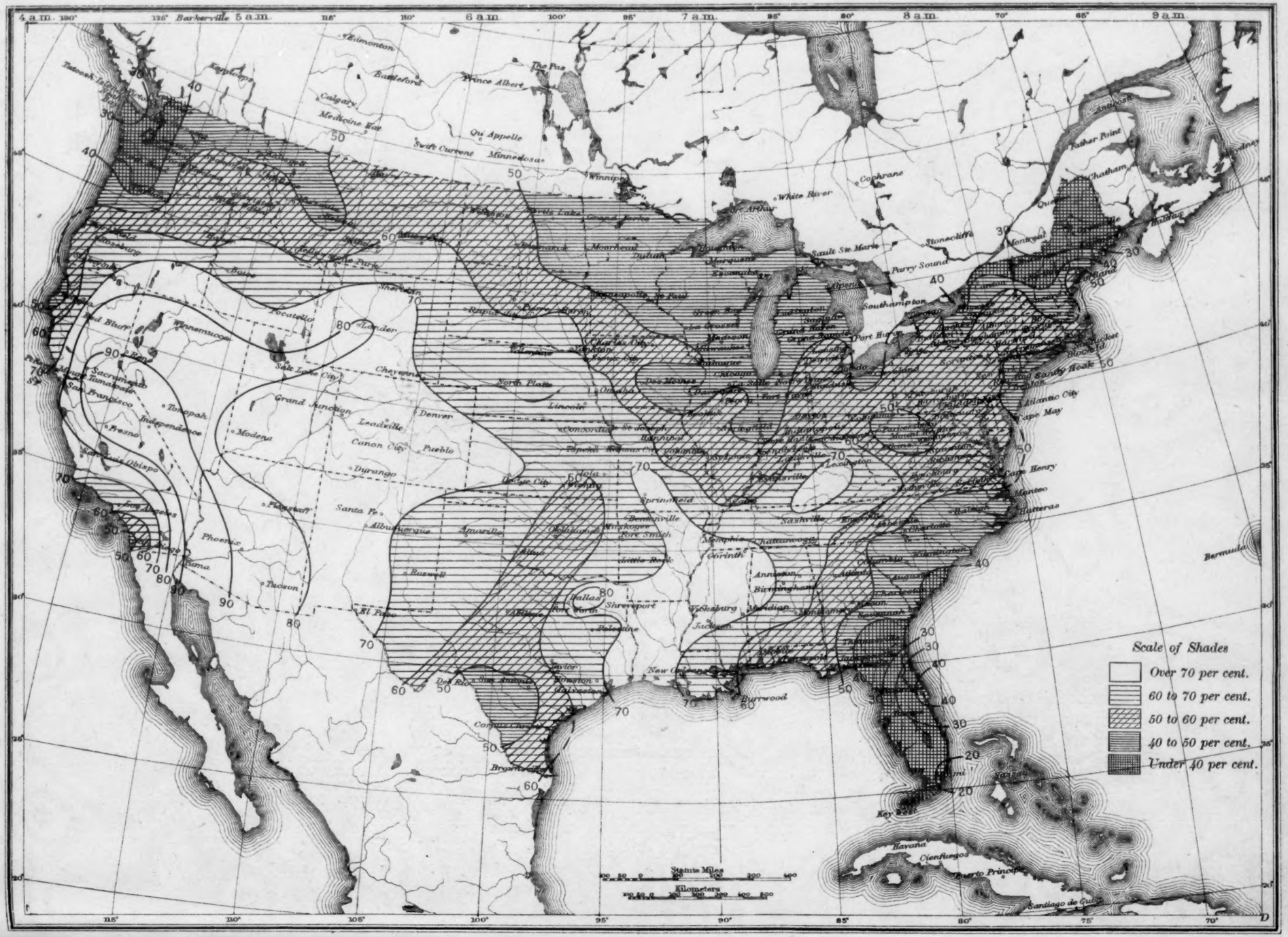


Chart V. Total Precipitation, Inches, June, 1930. (Inset) Departure of Precipitation from Normal

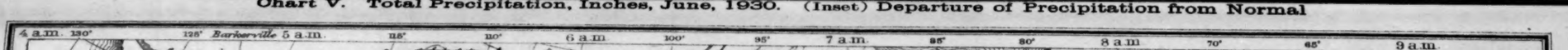
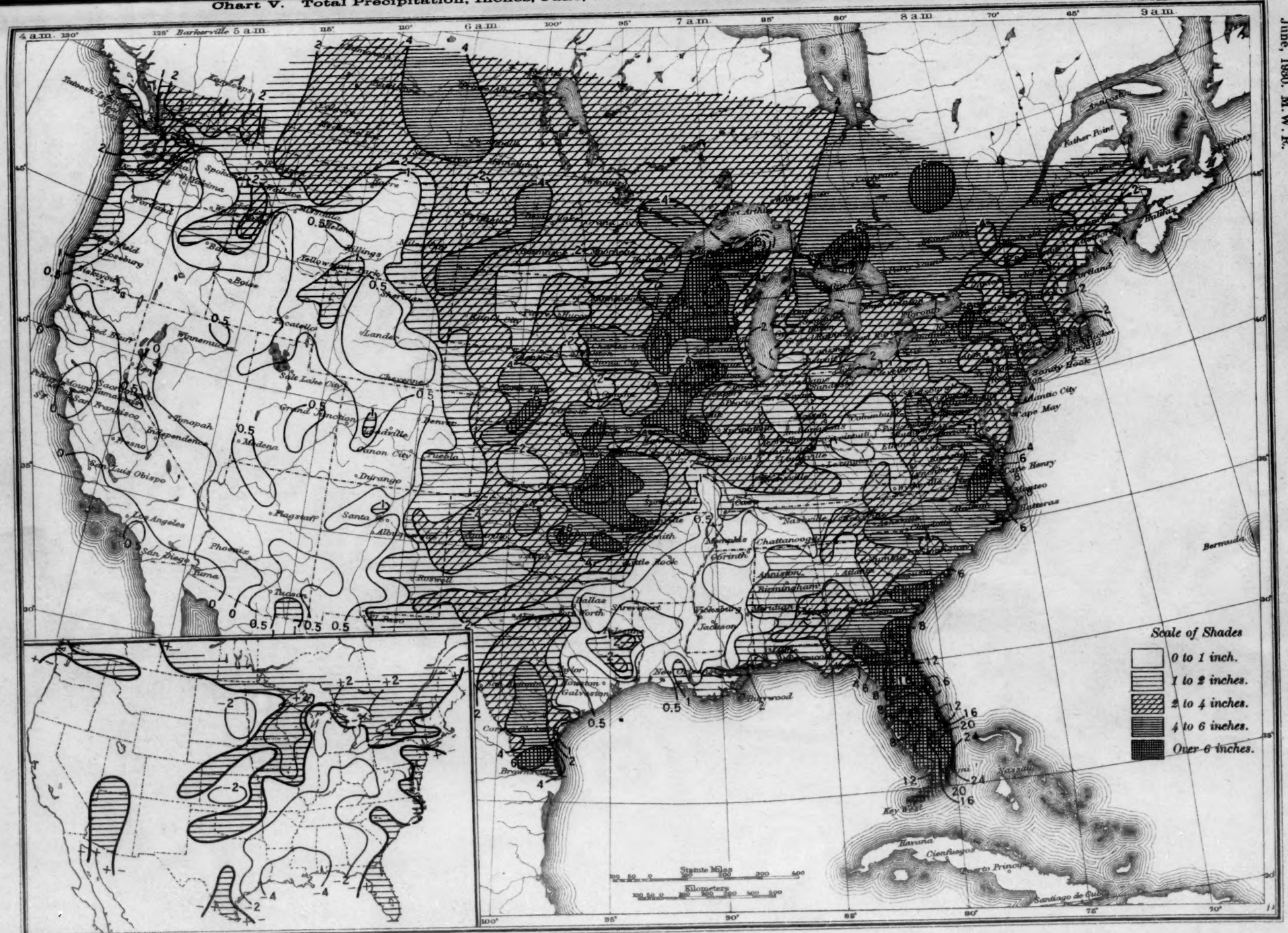


Chart V. Total Precipitation, Inches, June, 1930. (Inset) Departure of Precipitation from Normal



UNIV. OF MICH.

Chart VI. Isobars at Sea level and Isotherms at Surface; Prevailing Winds, June, 1930

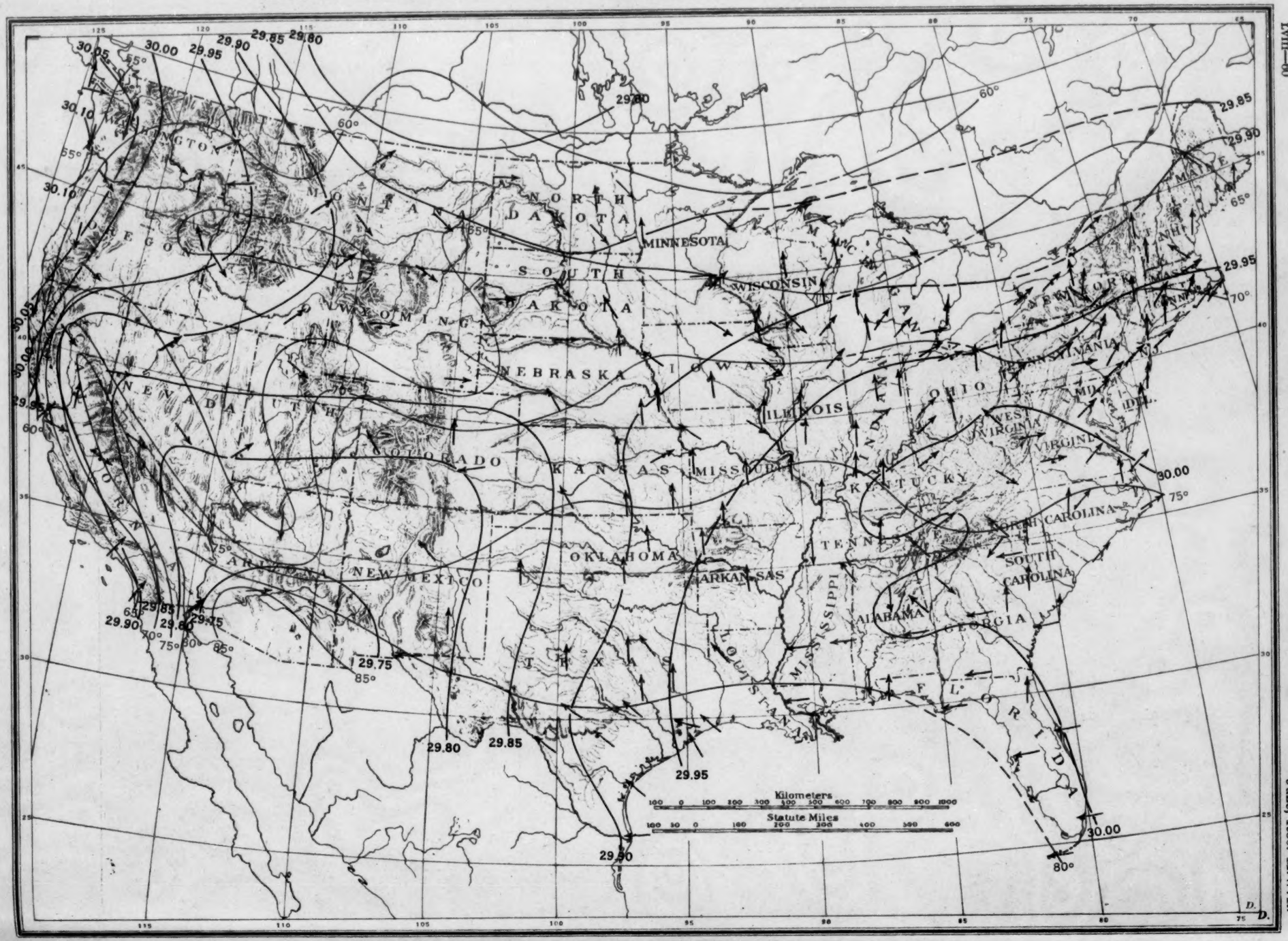


Chart VIII. Weather Map of North Atlantic Ocean, June 23, 1930
(Plotted by F. A. Young)

Chart VIII. Weather Map of North Atlantic Ocean, June 23, 1930

(Plotted by F. A. Young)

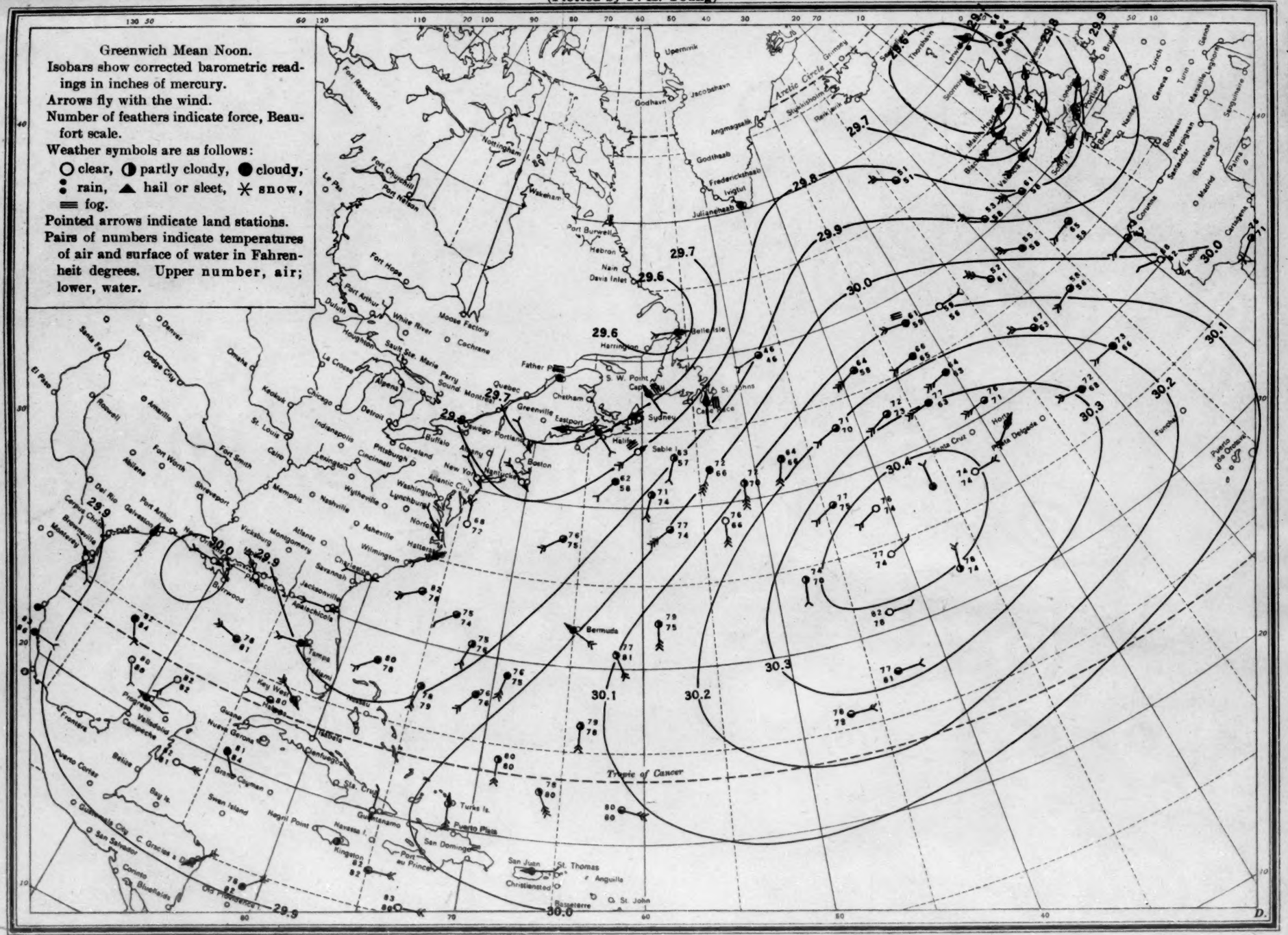


Chart IX. Weather Map of North Atlantic Ocean, June 24, 1930

(Plotted by F. A. Young)

Greenwich Mean Noon.

Isobars show corrected barometric readings in inches of mercury.

Arrows fly with the wind.

Number of feathers indicate force, Beaufort scale.

Weather symbols are as follows:

○ clear, ◑ partly cloudy, ● cloudy, ⁝ rain, ▲ hail or sleet, ✳ snow, ═ fog.

Pointed arrows indicate land stations.

Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water.

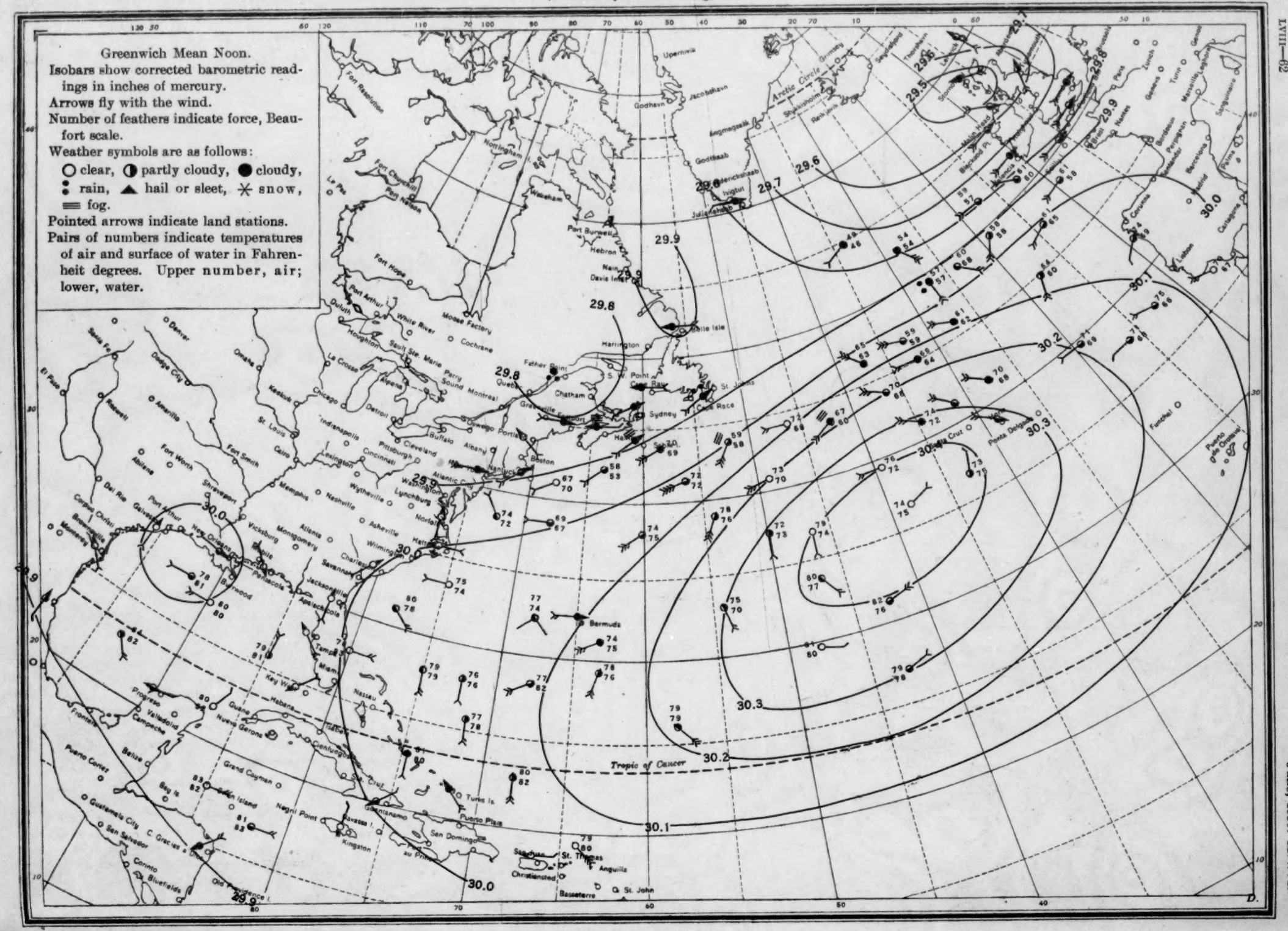
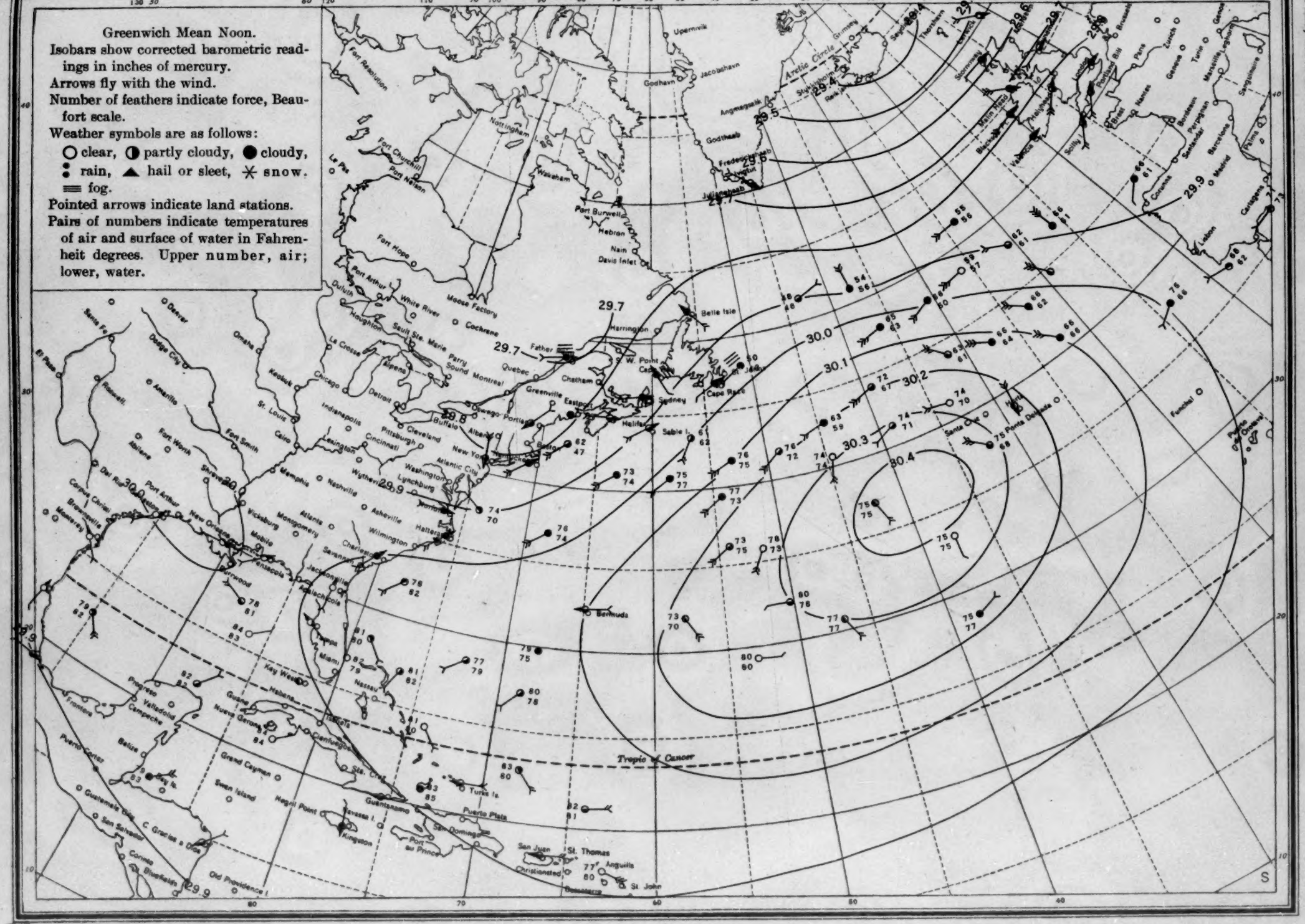


Chart X. Weather Map of North Atlantic Ocean, June 25, 1930

(Plotted by F. A. Young)

Chart X. Weather Map of North Atlantic Ocean, June 25, 1930
(Plotted by F. A. Young)

Greenwich Mean Noon.
Isobars show corrected barometric readings in inches of mercury.
Arrows fly with the wind.
Number of feathers indicate force, Beaufort scale.
Weather symbols are as follows:
○ clear, ◑ partly cloudy, ● cloudy,
⁝ rain, ▲ hail or sleet, ✳ snow,
≡ fog.
Pointed arrows indicate land stations.
Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water.



UNIV. OF MICH.

Chart XI. Weather Map of North Atlantic Ocean, June 26, 1930

(Plotted by F. A. Young)

Greenwich Mean Noon.

Isobars show corrected barometric readings in inches of mercury.

Arrows fly with the wind.

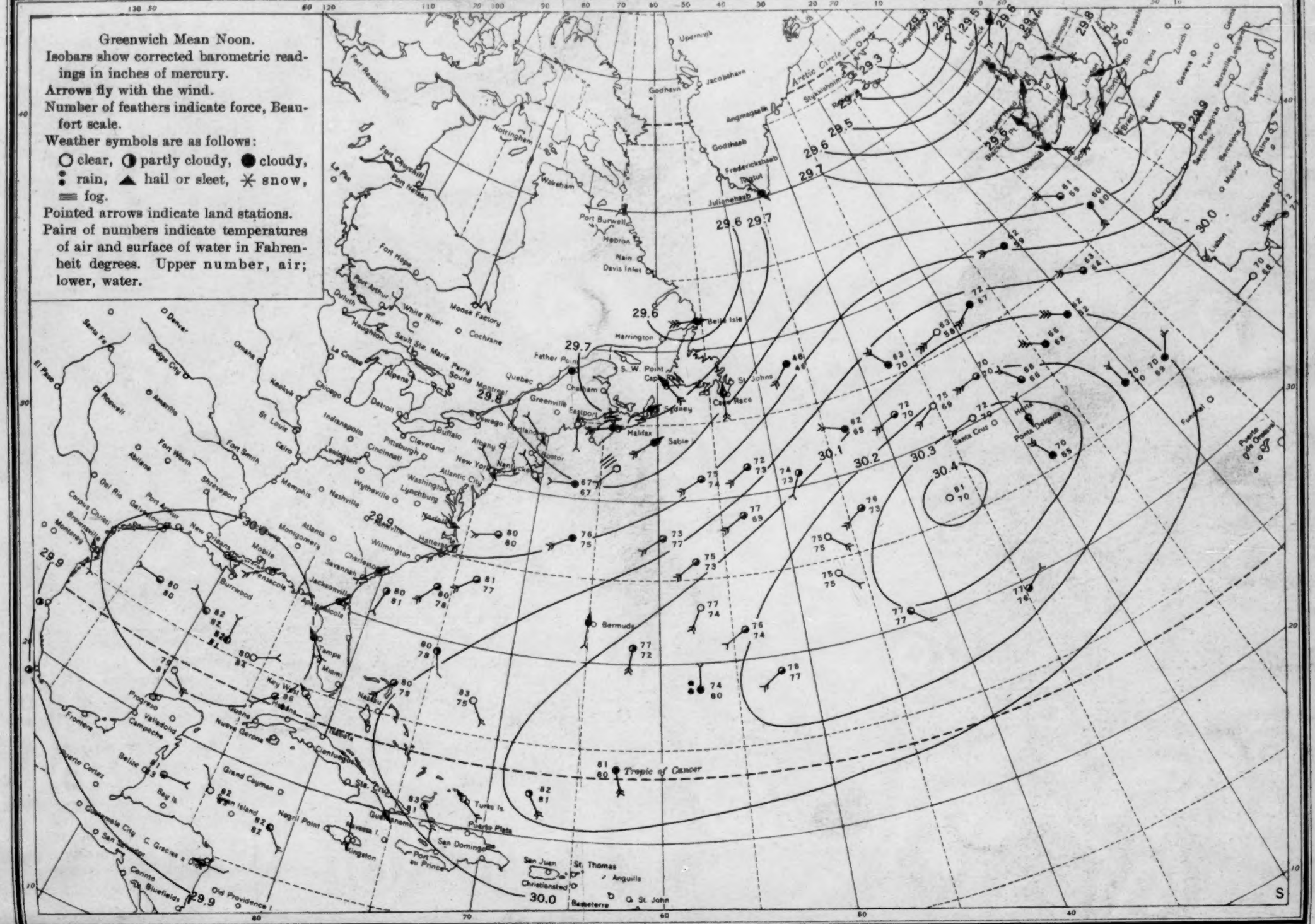
Number of feathers indicate force, Beaufort scale.

Weather symbols are as follows:

○ clear, ◑ partly cloudy, ● cloudy, ⁝ rain, ▲ hail or sleet, ✳ snow, ═ fog.

Pointed arrows indicate land stations.

Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water.


Arctic Circle
Tropic of Cancer
Upernivik
Jacobshavn
Godhavn
Angmagssalik
Godthaab
Fredericksdaab
Julianehaab
Nottingham I.
Wakeham
Port Burwell
Hebron
Nain
Davis Inlet
Fort Churchill
Port Nelson
Fort Hope
Moose Factory
Port Arthur
Duluth
White River
Cochrane
Sault Ste. Marie
Perry Sound
Father Point
Quebec
Montreal
Chatham
Greenville
Eastport
Portland
Boston
Nantucket
Halifax
Sable I.
S. W. Point
Cape Race
St. Johns
Sydney
Belle Isle
Harrington
Bermuda
Turks Is.
Puerto Plata
San Domingo
Port au Prince
San Juan
St. Thomas
Anguilla
Christiansted
Basseterre
St. John
Old Providence I.
Bluefields
Grand Cayman
Negril Point
Havana
Key West
Tampa
Miami
Progreso
Campeche
Vallasolid
Frontera
Belize
Bay Is.
Guatemala City
C. Gracias a Dios
Puerto Cortez
Nuevas Gerona
Cienfuegos
Santa Cruz
Guantanamo
Nassau
Progreso
Mobile
New Orleans
Pensacola
Apalachicola
Jacksonville
Savannah
Charleston
Wilmington
Hatteras
Norfolk
Atlantic City
Washington
Lynchburg
Wytheville
Memphis
Nashville
Atlanta
Montgomery
Shreveport
Fort Worth
Abilene
Del Rio
Corpus Christi
Brownsville
Monterey
Galveston
Port Arthur
Burrwood
Fort Smith
Cairo
Indianapolis
Cincinnati
Pittsburgh
Cleveland
Buffalo
Albany
New York
Nantucket
Detroit
Chicago
St. Louis
Kansas City
Omaha
La Crosse
Alpena
Duluth
Houghton
Sault Ste. Marie
Perry Sound
Montreal
Quebec
Greenville
Eastport
Portland
Boston
Halifax
Sable I.
Sydney
Cape Race
St. Johns